CLASS 204, CHEMISTRY: ELECTRICAL AND WAVE ENERGY

SECTION I - CLASS DEFINITION

STATEMENT OF CLASS SUBJECT MATTER

This class includes, where not provided for elsewhere:

A. Processes (1) involving the use of electrolysis (as provided for in Class 205); (2) of preparing or purifying compounds or elements involving chemical reaction brought about by electrical or wave energy in a magnetic field; (3) of treating materials involving chemical reaction brought about by wave energy; (4) of preparing or purifying compounds or elements involving chemical reaction brought about by an electrostatic field or electrical discharge; (5) involving the use of electrophoresis or electro-osmosis; (6) of treating a liquid (a) to separate or purify the liquid using electric and magnetic fields simultaneously, (b) to separate or purify the liquid using an electric field, or (c) using a magnetic field to obtain some effect other than mere separation or purification of the liquid; (7) involving coating, forming, or etching by the use of sputtering; and (8) involving coating by the use of vacuum arc discharge. (See Subclass References to the Current Class, below.)

B. Products solely disclosed as made by a process under (A). For exceptions, see Lines With Other Classes and Wtihin This Class, Exceptions, below.

C. Apparatus for carrying out the processes set forth under (A) except the apparatus used to carry out the wave energy treatment processes provided for in Class 204; such apparatus is provided for elsewhere. (See Lines With Other Classes, below.)

D. Electrolyte compositions specialized for use in electrolytic processes or methods of preparing the compositions.

(1) Note. A list of superiority of several composition classes appears elsewhere. See Lines With Other Classes below.

(2) Note. Although the processes described above in (A), items (6), (7), and (8), do not involve strictly chemical changes, they are in some respects closely related to other portions of the class and so have been included here.

(3) Note. Processes involving purely thermal actions of electrical phenomena or wave energy are not included in this class.

(4) Note. Class 204 provides for the combination of electrical and wave energy processes as described in (A) above with subsequent: (1) conventional treatments such as filtering, distilling, washing, and other methods of separating or concentrating products from the previous Class 204 operation or (2) mere admixing of products from the previous Class 204 operation to form a desired end product. Where a subsequent step significantly modifies a composition, product, or article made by the previous Class 204 operation, the combined process is generally provided for elsewhere and is cross-referenced in Class 204, where necessary.

(5) Note. The combination of an electrical or wave energy operation as described in (A) above with a preceding method, such as treatment of material to prepare it for the electrical or wave energy operation, is provided for in Class 204. When a method preparatory to a Class 204 operation is claimed, per se, and is not provided for elsewhere, it may be classified in Class 204.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

For apparatus for carrying out the wave energy treatment processes provided for in Class 204, subclasses 157.15+, see Class 250, Radiant Energy, particularly subclasses 492.1+, and Class 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, particularly subclasses 186+; the apparatus used to carry out the processes provided for in Class 204, subclasses 155+; such apparatus is provided for in Class 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, particularly subclasses 186.01+; the apparatus used to carry out the processes provided for in Class 204, subclasses 164; such apparatus is provided for in Class 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing particularly subclasses 186.04+; and the section References to Other Classes, herein, the

entry to Class 118 for apparatus provided for in Class 118.

The rules for determining Class placement of the Original Reference (OR) for claimed chemical compositions are set forth in the Class Definition of Class 252 in the section LINES WITH OTHER CLASSES AND WITHIN THIS CLASS, subsection COMPOSITION CLASS SUPERIORITY, which includes a hierarachical ORDER OF SUPERIORITY FOR COMPOSITION CLASSES.

EXCEPTIONS

This class includes, where not provided for elsewhere products solely disclosed as made by a process under (A) in Class Definition, above, with the following exceptions: (1) products which comprise two or more contiguous metallic layers; (2) products of processes classifiable in Class 204, subclasses 157.15+ and 450+, and Class 205, subclasses 640+. These products are properly classified in the appropriate product or stock material class (e.g., 260, 423, 428, etc.).

LINE BETWEEN CLASS 204 AND CLASS 75

Combinations of metallurgical process steps falling within the definition of Class 75 and electrical or wave energy steps falling under the definition of Class 204 are classified in Class 204, when the metallurgical process steps are preparatory to the electrical or wave energy steps, and are placed in Class 75 when the electrical or wave energy methods are preparatory to the metallurgical process steps. The above applies even when such preparatory steps result in a desired by-product. Class 75, subclasses 228+, provides for a “nominal” element usable in a Class 204 process (i.e., an element claimed only in terms of the metal composition from which it is made). The order of superiority among various metal, alloy, and metal stock areas and methods of manufacture involving them is as follows:

1. Class 419, Powder Metallurgy Processes.

2. Class 148, Metal Treatment, subclasses 22+, compositions for treatment of solid metal.

3. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 300, 301, and 303+, gaseous, liquid, or solid treating compositions for liquid metal or charges, and subclass 302, welding rods defined by composition.

4. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+, consolidated metal powder compositions, and subclasses 255+, loose metal particulate mixtures.

5. Class 420, Alloys or Metallic Compositions, alloys or metallic compositions claimed as products.

6. Class 148, Metal Treatment, subclasses 95-122, 194-287, and 500-714, in class schedule order, certain processes of treating solid or semisolid metal by modifying or maintaining internal physical structure (i.e., microstructure) or chemical properties of metal, processes of reactive coating of metal, or processes of chemical heat-removing (e.g., flame-cutting, etc.) or burning of metal. However, if metal casting, fusion bonding, machining, or working is involved, there is a requirement of significant heat treatment as described in References To Other Classes in the Class 148 definition.

7. Class 148, Metal Treatment, subclasses 33+, p-n type barrier layer stock material, and subclasses 400+, stock.

8. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 331+, processes of making solid particulate alloys directly from liquid metal, and subclasses 343+, processes of producing or purifying alloys in powder form.

9. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 10.1+ and 10.67, electrothermic, electromagnetic, or electrostatic processes of making alloys.

10. Class 420, Alloys or Metallic Compositions, processes of manufacture.

11. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 330+, processes of making metal, treating liquid metals and liquid alloys, and consolidating metalliferous material.

12. Class 204, Chemistry: Electrical and Wave Energy, processes.

13.Class 164, Metal Founding, subclasses 1+, processes.

14. Class 266, Metallurgical Apparatus, subclasses 44+, processes of operating metallurgical apparatus.

LINES BETWEEN CLASSES 156, 204, 205, AND 216

In general, a class 156 operation (e.g., chemical etching of an electrical function semiconductor substrate, etc.) performed on a composition, product, or article made by a Class 204 process (e.g., an entire article previously etched by electrolysis, a product portion modified by electrolytic material treatment, etc.) is considered to provide a significant modification of the composition, product, or article made by the Class 204 process; therefore placing the combination of a Class 204 process followed by a Class 156 procedure in Class 156. However, the combination of a Class 204 electrolytic coating step followed by a Class 156 operation (other than a laminating process as described above) performed (1) to allow at least a portion of the electrolytic coating to remain and (2) to only significantly modify the electrolytic coating, per se, is considered to be an electrolytic coating process followed by a mere perfecting step for the electrolytic coating; therefore placing the combination in Class 204. The significant modification of only the electrolytic coating allows for mere incidental alterations to other portions of a coated article such as the substrate, provided that such changes are clearly unintentional (e.g., chemical etching through an electrolytic coating which may also progress into the substrate in some areas to allow complete penetration through all desired other areas of the electrolytic coating, etc.). Class 156, subclasses 625.1+, provide for the original classification of chemically etching an electrical function semiconductive precursor, substrate, or device when the claims are alternative (claims to a Class 156 etching process and claims to a Class 205 electrolytic etching, or when a generic claim is present and no species is specifically claimed). When, however, a generic claim is present (disclosure includes both Class 156 etching and Class 204 or Class 205 subject matter) and a Class 204 or Class 205 species is specifically claimed, and there is no specific claim to a Class 156 etching process, the original classification is in Class 204 or Class 205 and a mandatory cross-reference is placed into Class 156 etching based on the generic claim. Other combinations of Class 204 step(s) with Class 156 step(s) will follow the general class line for the combination of Class 204 step(s) with those from other classes as stated at the beginning of Class 204. Also, see the search class note to Class 216 in this section, since Class 216 is an integral part of Class 156.

LINES BETWEEN CLASSES 216, 156, 204, AND 205

Chemical etching performed on a composition, product, or article made by a Class 204 process (e.g., an entire article previously etched by electrolysis, a product portion modified by electrolytic material treatment, etc.) is considered to provide a significant modification of the composition, product, or article made by the Class 204 process; therefore placing the combination of a Class 204 process followed by Class 216 chemical etching in Class 216. However, the combination of a Class 205 electrolytic coating step followed by Class 216 chemical etching performed (1) to allow at least a portion of the electrolytic coating to remain and (2) to only significantly modify the electrolytic coating, per se, is considered to be an electrolytic coating process followed by a mere perfecting step for the electrolytic coating; therefore placing the combination in Class 205. The significant modification of only the electrolytic coating allows for mere incidental alterations to other portions of a coated article such as the substrate, provided that such changes are clearly unintentional (e.g., chemical etching through an electrolytic coating which may also progress into the substrate in some areas to allow complete penetration through all desired other areas of the electrolytic coating, etc.). Class 216 also provides for the original classification when the claims are alternative (claims to a Class 216 process and claims to a Class 205 electrolytic etching, or when a generic claim is present and no species is specifically claimed). When, however, a generic claim is present (disclosure includes both Class 216 and Class 204 or Class 205 subject matter) and a Class 204 or Class 205 species is specifically claimed, and there is no specific claim to a Class 216 etching process, the original classification is in Class 204 or Class 205 and a mandatory cross-reference is placed into Class 216 based on the generic claim. Other combinations of Class 204 step(s) with Class 216 step(s) will follow the general class line for the combination of Class 204 step(s) with those from other classes as stated at the beginning of Class 204. Also, see the search class note to Class 156 in this section, since Class 216 is an integral part of Class 156.

LINE BETWEEN CLASS 250 AND CLASS 204

Note the difference between the scope of “radiant energy” as set out for Class 250 and “wave energy” as defined in Class 204, subclass 157.15.

LINE BETWEEN CLASSES 260, 204, AND 520

See Class 260, Chemistry of Carbon Compounds, for (1) a chemical process, in general and for preparation and treatment of carbon compounds or a product formed

by such a process; (2) the combination of a Class 204 operation with a subsequent significant chemical process provided for in Class 260 when the subsequent Class 260 process modifies a product of the Class 204 operation to produce a different compound; and (3) a branched process in which one branch is a Class 204 process and another branch falls within the class definition of Class 260. The combination of a Class 260 process and a subsequent Class 204 operation is classified in Class 204. The foregoing applies even when the preparatory process or operation results in a desired by-product. Also, see the search class note to Class 520 in References to Other Classes, since Class 520 is an integral part of Class 260.

LINES BETWEEN CLASSES 424, 204, AND 514

See Class 424, Drug, Bio-Affecting and Body Treating Compositions, for a drug, bio-affecting, or body treating composition which may be made by a Class 204 process; especially subclasses 1.11+ for a radionuclide or intended radionuclide containing, adjuvant or carrier, intermediate, or preparatory composition. Also, see the search class note to Class 514 in REFERENCES TO OTHER CLASSES, below, since Class 514 is an integral part of Class 424.

LINES BETWEEN CLASSES 520, 522, AND 204

See Class 520, Synthetic Resins or Natural Rubbers -- Part of the Class 520 Series, appropriate classes, especially Class 522, subclasses 1+, for a composition to be polymerized by wave energy wherein said composition contains a rate-affecting material; or a synthetic resin composition to be modified by wave energy wherein said composition contains a rate-affecting material; or a process of preparing or treating a solid polymer utilizing wave energy. Any process step involving electrolysis, electric current, electro-osmosis, electrophoresis, electrostatic field, electrical discharge, or magnetic field and also involving the treating of a synthetic resin or natural rubber is proper in Class 204 if a wave energy step is involved in any part of the process. The combination of a Class 520 chemical process not involving the use of wave energy with a Class 204 operation is classified (1) in Class 204 when the Class 520 nonwave energy process is preparatory to the Class 204 operation and (2) in Class 520 when the Class 204 operation is preparatory to the Class 520 nonwave energy process. A branching process in which the claims are alternative to producing or treating a polymer by a Class 204 process or by a Class 520 chemical process not involving the use of wave energy is classified in Class 520. See Class 204, subclass 157.15, for a further elaboration of the line between Class 204 and Class 520, subclasses 1+.

LINES BETWEEN CLASSES 585, 204, AND 260

The line between Class 585 and Class 204 is analogous to that between Class 260 and Class 204. See the search class note to Class 260 in REFERENCES TO OTHER CLASSES, below.

SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

SEE OR SEARCH THIS CLASS, SUBCLASS:

155+, for preparing or purifying compounds or elements involving chemical reaction brought about by electrical or wave energy in a magnetic field.

157.15+, for treating materials involving chemical reaction brought about by wave energy.

164+, for preparing or purifying compounds or elements involving chemical reaction brought about by an electrostatic field or electrical discharge.

192.1+, for processes involving coating, forming, or etching by the use of sputtering .

192.38, for processes involving coating by the use of vacuum arc discharge.

450+, for processes involving the use of electrophoresis or electro-osmosis.

554+, for treating a liquid (a) to separate or purify the liquid using electric and magnetic fields simultaneously, (b) to separate or purify the liquid using an electric field, or (c) using a magnetic field to obtain some effect other than mere separation or purification of the liquid .

SECTION IV - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

8, Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers, for bleaching or dyeing, fluid treatment, and chemical modification of textiles and fibers using electrical, radiant, or wave energy; without involving electrolysis (electrolytic treatment of organic fibrous material is provided for in Class 205, subclasses 689+).

47, Plant Husbandry, subclass 1.3 for processes and apparatus for culture of plants by using electricity.

75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, for (1) general production of metals, (2) electrothermal processes of preparing metals and alloys, and (3) branching processes in which one branch comprises a process falling within the definition of Class 204 and which contains at least one other branch falling within Class 75. See Lines With Other Classes, above, for further discussion of the line between Class 75 and Class 204.

101, Printing, appropriate subclasses for electrotype molds, matrices, or other printing members which may be produced by electrolytic coating, electroforming, or cathode sputtering methods. For processes of their production by such methods, see Class 204, appropriate subclasses.

118, Coating Apparatus, for a general coating apparatus which does not involve the use of electrolysis, electrophoresis, electro-osmosis, or cathode sputtering. Class 204 provides for apparatus having means for combined coating operations in which at least one coated layer is applied by electrolysis, electrophoresis, electro-osmosis, or cathode sputtering. However, Class 118 provides for coating apparatus which also has means to subsequently cure (considered to be a mere perfecting step) the coating using electrical or wave energy.

128, Surgery, for electrical or wave energy treatment of the living human body and apparatus specialized therefor.

131, Tobacco, subclass 294, 295, and 299 for processes of treating tobacco with electrical or radiant energy.

134, Cleaning and Liquid Contact With Solids, subclasses 1+ for processes of cleaning solids by the application of electric, wave, ray or radiant energy to the work, other than broadly recited radiant heat energy.

148, Metal Treatment, particularly subclass 518 for processes of treating solid or semisolid metal to modify or maintain the internal physical structure (i.e., micro structure) or chemical properties of metal combined with a Class 204 procedure. Class 148 takes the combination, whether the Class 148 operation precedes or is subsequent to the Class 204 procedure. Also, see Class 148, subclasses 240+ for the location of processes of reactive coating of metal wherein an externally applied agent combines with the metal substrate to form a coating thereon which contains an element from the metal substrate. Combinations that involve reactive coating as defined in Class 148, subclasses 240+, and a Class 204 coating operation are proper in Class 204. Combinations of a Class 148 reactive coating, a Class 204 coating operation, and an etching operation that occurs while the electrocoated layer still exists are in Class 204. However, combinations of carburizing or nitriding of metal, as defined in Class 148, subclasses 206+, with a Class 204 operation are proper for Class 148.

156, Adhesive Bonding and Miscellaneous Chemical Manufacture, subclasses 625.1+ for a process of chemically etching an electrical function semiconductive precursor, substrate, or device and subclasses 60+ for surface bonding and/or assembly therefor, particularly subclasses 150+ for a laminating process combined with at least one Class 204 step of electrodeposition (i.e., by electrolysis, electrophoresis, electro-osmosis, or cathode sputtering). See Lines With Other Classes and Within This Class, for discussion of the lines between Classes 156, 204, 205, and 216.

208, Mineral Oils: Processes and Products, for processes of treatment and preparation of mineral oils employing mere electrical thermal effects.

209, Classifying, Separating, and Assorting Solids, for electrical or wave energy classification, separation, or assortment of solids, particularly subclasses 127.1+ for electrostatic processes and apparatus, subclasses 179+ for electrical amalgamation processes and apparatus, and subclasses 212 and 213+ for magnetic separating processes and apparatus.

210, Liquid Purification or Separation, subclasses 600+ for purification or separation of a liquid which may include a Class 204-type step of making an agent used in the process. A process of treating the liquid directly by a Class 204 step to purify or separate it will be placed in Class 204 whether or not combined with a physical separation step classifiable in Class 210, subclasses 767+. Class 210 will take the combination of a 210 process, other than mere separation (as provided for in subclasses 767+), with a Class 204 operation. However, a Class 204 process (e.g., synthesis) preceded by a Class 210 step which is ancillary to the process will be placed in Class 204.

216, Etching a Substrate: Processes, for a chemical etching process, in general. See Lines With Other Classes and Within This Class for a dis-

cussion of the lines between Class 216, 156, 204, and 205.

250, Radiant Energy, for radiant energy processes and apparatus, particularly subclasses 281+ for ionic separation or analysis of materials utilizing the mass to electric charge ratio of particles. See Lines With Other Classes and Within This Class for a discussion of the lines between Class 250 and Class 204.

260, Chemistry of Carbon Compounds, for a chemical process, in general. See Lines With Other Classes and Within This Class for a discussion of the lines between Classes 260, 204, and 520.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though nonelectrical values may be derived therefrom; especially subclasses 323+ for testing of underground formations by electrolytic methods (e.g., testing an oil well bore for water strata, etc.), subclasses 425+ for testing of an electrolyte to determine electrical properties thereof, and other appropriate subclasses for electrical testing processes or apparatus which is combined with a significant electrical testing circuit or is unrelated to the subject matter of Class 204.

361, Electricity: Electrical Systems and Devices, subclasses 230+ for ionization apparatus, in general, and subclasses 500+ for electrolytic apparatus which is utilized for a purpose other than to produce a desired chemical change.

373, Industrial Electric Heating Furnaces, for electric furnaces and methods of using them, in general, especially subclasses 60+ for electric arc furnaces and methods of using them in which an electric arc is used as a heating means and the reactions performed are a result of the mere thermal effects of the electric arc.

420, Alloys or Metallic Compositions, appropriate subclasses for a "nominal" element usable in a Class 204 process (i.e., an element claimed only in terms of the alloy or metallic composition from which it is made) and for processes of producing an alloy or metallic composition. See the class definition of Class 420 for a description of the class line between Class 75 and Class 420. Also, see the search class note to Class 75 in this section for the order of superiority among various metal, alloy, and metal stock areas and methods of manufacture involving them.

423, Chemistry of Inorganic Compounds, for (1) a chemical process of producing an inorganic compound or nonmetallic element, in general; (2) the combination of a Class 204 operation with a subsequent chemical process provided for in Class 423 when the Class 423 process modifies a product of the Class 204 operation to produce a different compound or element, and (3) a branched process in which one branch is a Class 204 process and another branch falls within the definition of Class 423. The combination of a Class 423 process with a subsequent Class 204 operation which modifies a product of the Class 423 process is classified in Class 204. In processes where a useful by-product is formed, the patent is classified according to the primary product ultimately produced.

424, Drug, Bio-Affecting and Body Treating Compositions, for a drug, bio-affecting, or body treating composition. See Lines With Other Classes and Within This Class, for the a discussion of the lines between Classes 424, 204, and 514.

426, Food or Edible Material: Processes, Compositions, and Products, especially subclass 234, 235, 236, and 237+ for processes of preparing, preserving, and treating food involving the use of electrical or wave energy, including electrolysis.

427, Coating Processes, for general coating processes. Class 204 provides for processes involving combined coating operations in which at least one coated layer is applied by a Class 204 coating operation. However, a Class 427 coating step followed by curing (considered to be a mere perfecting step) of the 427 coating using electrical or wave energy is proper for Class 427.

428, Stock Material or Miscellaneous Articles, appropriate subclasses for a stock material product not elsewhere provided for in the form of a single or plural layer web or sheet. Also, see Lines With Other Classes and Within This Class in the class definition of Class 428 for an elaboration of the class line between Class 204 and Class 428.

429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, for an electrolyte, process, or apparatus specialized for the production of electrical current as a result of a chemical reaction or change of state (e.g., from a liquid to a gas, etc.).

435, Chemistry: Molecular Biology and Microbiology, for a process or apparatus involving measuring or testing by electrical or wave energy which is separate and apart, but in combination

with a process or apparatus for use with a viable microorganism or a catalytically active enzyme; and for a process or apparatus involving electrical or wave energy treatment of a microorganism or an enzyme when the treatment is solely disclosed for use with a viable micro-organism or a catalytically active enzyme.

436, Chemistry: Analytical and Immunological Testing, for a qualitative or quantitative chemical analysis including (1) a step of electrochemistry followed by at least one step of another chemical reaction not involving electrochemistry or (2) a process which is alternatively chemical or electrochemical.

502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, especially subclass 5 for the use of electrical, magnetic, or wave energy in making a catalyst, solid sorbent, or support therefor.

505, Superconductor Technology: Apparatus, Material, Process, subclasses 300+ for processes of producing high temperature (T_c > 30 K) superconductors, particularly subclass 411 for sputter etching, subclass 472 for electrolytic or electrophoretic coating, or subclasses 475+ for sputter coating.

514, Drug, Bio-Affecting and Body Treating Compositions, as an integral part of Class 424, for a drug, bio-affecting, or body treating composition which may be made by a Class 204 process, especially subclasses 167+ for a composition including activated or irradiated ergosterol. Also, see the search class note to Class 424, since Class 514 is an integral part of Class 424.

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, appropriate subclasses for subject matter relating to: colloid systems (such as sols*, emulsions, dispersions, foams, aerosols, smokes, gels, or pastes) or wetting agents (such as leveling, penetrating, or spreading); subcombination compositions of colloid systems containing at least an agent specialized and designed for or peculiar to use in making or stabilizing colloid systems; compositions and subcombination compositions specialized and designed for or peculiar to use in breaking (resolving) or inhibiting colloid systems; processes of making the compositions or systems of the class; processes of breaking (resolving) or inhibiting colloid systems; in each instance, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art; when without involving electrolysis.

520, Synthetic Resins or Natural Rubbers -- Part of the Class 520 Series, appropriate classes. See Lines With Other Classes and Within This Classs for a discussion of the lines between Class 520, 204, and 522.

585, Chemistry of Hydrocarbon Compounds, for a process of synthesizing or purifying a hydrocarbon compound. See Lines With Other Classes and Within This Class for a discussion of the lines between Classes 585, 204, and 260, and also see the search class note to Class 260 in this section.

588, Hazardous or Toxic Waste Destruction or Containment, for destruction of containment of hazardous or toxic waste by using electrical wave energy, especially subclass 204 for electrolytic or electrodialytic degradation or containment.

700, Data Processing: Generic Control Systems or Specific Applications subclasses 266 through 274 for chemical process control or monitoring systems in combination with a data processing system or calculating computer.

SECTION V - GLOSSARY

ACYCLIC

For the purposes of this class, “acyclic” refers to an organic compound which does not contain a heterocyclic, nitrocyclic, or carbocyclic nucleus.

ALKALI-FORMING METAL

A metal element chosen from the group consisting of the alkali metals (lithium (Li), sodium (Na), potassium (K), rubidium (Rb), cesium (Cs), and francium (Fr)), the alkaline earth metals (calcium (Ca), strontium (Sr), barium (Ba), and radium (Ra)), and magnesium (Mg) (included due to its similarity in properties to the alkaline earth metals).

DESIGNATED CHEMICAL COMPOSITION (DCC)

A composition in which at least one of the chemical atoms can either be deduced with certainty or be determined to belong to a limited select group of elements (as indicated in the exemplary lists of terms provided below); except that for the purposes of this class,

"organic" is considered to be too broad, eventhough inherently reciting the presence of a carbon atom. An exemplary list of terms used to describe compositions to be regarded as DCC's is as follows: alcohol, alkali or alkaline earth metal, amine, carbon black, carboxylic acid, chalcogen, drying oil, ether, fat, fatty acid or ester, halogen, hydrocarbon, latex, metal hydrate, peroxide, peroxy-, proton donor, sulfide, water, etc. An exemplary list of terms used to describe compositions not to be regarded as DCC's is as follows: amphoteric, anionic, antioxidant, blue, cationic, cosolvent, conductor, crystalline, curing catalyst, deliquescent, dielectric, dispersant, drier, electrophoretic, emulsifier, fibrous, filler, fluorescent, free radical, gas, humectant, hydrophillic, inorganic compound, insulator, ionic, Lewis acid or base, liquid, lubricant, luminescent, metal containing, mineral, numerically described without designating a chemical atom or a limited select group of elements, organic compound, organic solvent, organometallic, particulate, phosphorescent, pigment, plastic, plasticizer, preservative, solid, solvent, stabilizer, surface active agent, surfactant, wax, Ziegler or Natta catalysts, etc. These lists are not intended to be exhaustive.

ELECTROLYSIS

A process which is characterized by conduction of an electric current between two or more electrodes through an electrolyte and resulting in a chemical change (e.g., oxidation, reduction, etc.) (other than that brought about by the mere heating effect of the electric current) at one or more of the electrodes (e.g., electrolytic coating or etching, etc.) or at another location in contact with the electrolyte as a direct result of the electric current passing therethrough (e.g., electrolytic material treatment, etc.), such chemical change being the process objective and not merely as a means of conducting an electric current through the electrolyte (as is the case in "electrophoresis" as defined in subclass 450 of this class).

ELECTROLYTE

A substance which is or forms a liquid, solid, or gel containing dissociated ions to conduct an electrolytic current (usually an ionic compound is dissolved in solution or melted into a fused state to provide an electrically conductive medium).

ESTER-TYPE WAX

A "wax" which is essentially an ester in chemical structure, (e.g., montan wax, carnauba wax, etc.).

FAT, FATTY OIL

A glyceride of a higher fatty acid, including naturally occurring mixtures thereof.

FATTY STILL RESIDUES

Bottoms, tars, or pitches resulting from the distillation of fats, fatty oils, and ester-type waxes, (e.g., stearine pitch, etc.).

HIGHER FATTY ACID

A monocarboxylic acid containing an unbroken chain of at least seven carbon atoms bonded to a carboxyl group, (e.g., stearic acid, etc.).

INTERNAL BATTERY

A device or means which generates an electrical current by chemical action within a zone of desired electrolysis without the need for an external source of electrical current.

ORGANIC COMPOUND

A chemical compound limited by the definition of a "carbon compound" found under the class definition in Class 260, Chemistry of Carbon Compounds.

PERMANENT COATING

A coating which remains as part of a finished article as distinguished from a coating which is formed upon and removed or stripped from a base or substrate.

PLATINUM METAL

A metal element from the group consisting of iridium (Ir), osmium (Os), palladium (Pd), platinum (Pt), and rhenium (Re).

PRECIOUS METAL

A metal element from the group consisting of gold (Au), platinum metals, and silver (Ag).

SYNTHESIS

For purposes of this class, "synthesis" includes the production of a desired element or compound by breaking down from complex forms to simpler ones as well as the building up of complex forms from simpler ones.

WAVE ENERGY

For the purposes of this class, “wave energy” includes radiation as well as wave energy transmitted by various mediums and embraces electromagnetic wave energy or radiation, sonic and supersonic waves, neutron, proton, deutron, and other types of corpuscular radiation.

SUBCLASSES

Processes and products:
This subclass is indented under the class definition. Processes falling and the products necessarily resulting therefrom where not provided for elsewhere.

155 Chemical processes which have for their purpose the preparation of compounds or elements through chemical reaction brought about by the agency of electrical or wave energy in which the reaction is carried out within a magnetic field; except electrolytic processes, provided for above, and those brought about through mere heating effect of electrical or wave energy. For example, the conversion of the surface of a polymeric material to produce a film thereon. This includes both the synthetic production of compounds or elements and, likewise, the chemical modification or chemical purification of compounds or elements, making use of electrical or wave energy to effect the chemical changes in such processes. The processes falling within these subclasses are those whose purpose is for the production of compounds, elements by chemical reactions, but not those wherein a material or composition is treated, such as a metal, tobacco, foods, beverages, leather and the like, and in which a chemical change may be brought about.

SEE OR SEARCH CLASS:
118, Coating Apparatus, for coating apparatus.
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 186+ for apparatus having means for initiating or perfecting chemical reaction using electromagnetic wave energy or corpuscular radiation and subclasses 127+ for apparatus having means to initiate or perfect a process using shock or sound wave.
427, Coating Processes, subclasses 457+ for processes of coating in general involving a magnetic base or coating.
588, Hazardous or Toxic Waste Destruction or Containment, appropriate subclasses for the use of electrical energy and magnetic force in the destruction of hazardous or toxic waste.

156 This subclass is indented under subclass 155. Processes in which the chemical reaction is carried out within a magnetic field including electrical discharges. The discharges may be produced by the same means as that which creates the magnetic field, such as an electromagnetic field of such character as produces discharges, or an additional electrical discharge field may be imposed.

SEE OR SEARCH CLASS:
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 186.03 for the corresponding apparatus.

157.15 Processes of treating materials by wave energy:
This subclass is indented under the class definition. Subject matter involving chemical reactions brought about by wave energy.

(1) Note. Subclasses 157.15+ provides for the following subject matter: (a) provides for preparing a compound or element, involving a chemical reaction induced by wave energy; said chemical reaction resulting in either (1) an element or chemical compound (2) a purified product (wherein the chemical reaction has assisted in the removal of a contaminant) or (3) an element (wherein the chemical reaction consists of decomposing a compound to produce the elemental form). (b) provides for any process of treating waste or unwanted material involving a chemical reaction induced by wave energy where there is no intent to recover a specified desired product. (c) provides for effecting optical rotation, i.e., d, 1 optical rotation for effecting a change in isomeric forms, e.g., cis to trans isomers by wave energy, etc. (d) provides for producing a photochromic material by using wave energy.

(e) provides for effecting a chemical reaction by wave energy where the product produced is a composition not disclosed as having a desired use. Materials which are compositions to begin with such as tobacco, foods, etc., are not proper for this area unless a final desired product is isolated which is a compound or element. (f) provides for the degradation of a chemical compound or polymer by wave energy to produce a chemical compound or element.

(2) Note. The utilization of wave energy to effect a color change is presumed to be a chemical reaction for purposes of this class unless otherwise stated in the specification.

(3) Note. The utilization of wave energy to increase the viscosity of a chemical compound is considered to be a chemical reaction for purposes of this class unless otherwise stated in the specification. Also included herein is a process of removing an embrittlement causing material from a metallic substance to reduce the embrittlement condition of metal.

(4) Note. The term “wave energy” includes radiation as well as wave energies transmitted by various mediums and embraces electromagnetic waves or radiations, sonic supersonic, ultrasonic waves, neutrons, protons, deutron and other corpuscular radiations.

(5) Note. The term “electromagnetic waves" as employed in the (4) Note above includes, e.g., X-ray and gamma-ray, ultraviolet, infra red, and visible light rays, and short electric and radio waves. Energy including wave energy processes which produces merely a thermal effect or heat waves, per se, even if a chemical reaction is induced is excluded under the provisions of the class definitions, see CLASS DEFINITIONS, REFERENCES TO OTHER CLASSES, and GLOSSARY in the main class definition.

(6) Note. Classification of documents into this area is on the basis of the wave energy step providing the final desired product and not necessarily on the first wave energy step recited if that product is not the ultimate desired product of the claim. An example of such a situation would be a wave energy step of preparing a nitrogen heterocyclic compound followed by a wave energy step of cleaving the heterocyclic ring whereby the final product is devoid of a heterocyclic ring but still contains a nitrogen atom. Classification in 157.81 rather than in 157.71 would be proper.

(7) Note. In those subclasses which are identified in the classification schedule as “using,” i.e., 157.22, 157.41, 157.42, 157.43, 157.44, 157.61, 157.62, 157.63 original placement has been on either specifically claimed subject matter or solely disclosed subject matter. Claims which are alternative but which specifically recite the subject matter of the above subclasses are considered as being claimed. An example of such a situation would be a claim reciting alternatively the use of a laser of X-ray to produce a desired nitrogen compound. Classification as an original in 157.61 would be proper. The rule to be followed is that if the claim does not meet the parameter of the “solely disclosed or claimed rule” it is classified below on some other aspect of the claim.

(8) Note. This area does not provide for products of a wave energy procedure nor does it provide for compositions or compounds which are to be exposed to wave energy. Patents with claims drawn to a process of preparing a compound in the presence of wave energy and the compound, per se, are originally classified in the appropriate product class (260, etc.). See Class 252, Compositions, in particular subclass 188.31 for compositions which are to be exposed to wave energy so as to produce a desired compound or element.

(9) Note. Processes of growing crystals, dissolving compounds, altering friability of particles, changing the structure in a crystal lattice or converting a substance into an amorphous state (e.g., Cg to Cd) are considered to be physical processes and thus are excluded from this class unless stated to be chemical reactions by the patentee.

SEE OR SEARCH CLASS:

260, Chemistry of Carbon Compounds, 518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, 530 - 570, Organic Compounds -- Part of the Class 532 - 570 Series, AND 585, Chemistry of Hydrocarbon Compounds, for (1) processes for purifying an organic compound wherein no chemical reaction induced by wave energy is involved and (2) for processes with subsequent chemical process steps when such latter steps modify the product of the wave energy method to produce a different compound and (3) organic products prepared in the presence of wave energy. A process of preparing an organic compound by a chemical reaction which reaction is generic so as to include or exclude a Class 204 wave energy step is classified with the nonwave energy step, i.e., 518, 530 - 570 or Class 585 and cross-reference to Class 204.

313, Electric Lamp and Discharge Devices, appropriate subclasses for electric lamps and electric space discharge devices such as ultraviolet light generators, and cathode-ray tubes. See especially subclass 112 for lamps and discharge devices having an envelope made of a material which will transmit invisible radiations and subclasses 364+ for cathode-ray tubes.

376, Induced Nuclear Reactions: Processes, Systems, and Elements, appropriate subclasses, especially subclasses 323+ for a chemical reaction carried out in a reactor.

378, X-Ray or Gamma Ray Systems or Devices, subclasses 119+ for X-ray sources, etc.

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 186+ for apparatus for carrying out the radiant energy chemical processes of this subclass, subclasses 127+ for apparatus having means to initiate or perfect a process using shock or sound wave, and subclasses 1+ for radiant or wave energy methods in general for preserving, disinfecting, and sterilizing.

423, Chemistry of Inorganic Compounds, for (1) processes of purifying an inorganic compound or nonmetallic element wherein no chemical reaction induced by wave energy is involved (2) for processes with subsequent chemical process steps when such latter steps modify the product of the wave energy method to produce a nonmetallic element or different inorganic compound and (3) inorganic products prepared in the presence of wave energy. A process of preparing an inorganic compound or free nonmetallic element by a chemical reaction which reaction is generic so as to include or exclude a Class 204 wave energy step is classified with nonwave energy step, i.e., Class 423 and cross-reference to Class 204.

427, Coating Processes, for general coating processes; especially subclasses 457+ for direct application of electrical, magnetic, wave, or particulate energy (without effecting a chemical reaction) as part of a coating process (including pre- or post-treatment). Class 204 provides for processes involving combined coating operations in which at least one coated layer is applied by a Class 204 coating operation. However, a Class 427 coating step followed by curing (considered to be a mere perfecting step) of the 427 coating using electrical or wave energy is proper for Class 427.

430, Radiation Imagery Chemistry: Process, Composition, or Product Thereof, appropriate subclasses for radiation sensitive compositions and

elements and for processes of exposing said compositions or elements to wave energy in an imagewise exposure technique.

435, Chemistry: Molecular Biology and Microbiology, subclasses 173.1+ for electrical or wave energy treatment of micro-organisms or enzymes.

520, Synthetic Resins or Natural Rubbers, in particular Class 522, for processes of preparing or treating a solid polymer utilizing wave energy and compositions to be polymerized or modified by wave energy wherein said composition contains a rate affecting material. Class 520, subclasses 1+ also provides for products which are the result of a chemical modification utilizing wave energy. Class 204 is superior to Class 520, subclasses 1+ therefore a patent claiming in the alternative a process of preparing an organic compound and a synthetic resin in the presence of wave energy is classified for original in purposes in Class 204 and cross-reference into Class 520. In the situation where an alternative claim is presented as well as a specific claim to the synthetic is synthetic resin species and there is no specific claims to nonresin species, e.g., the organic compound, etc., the same rule of original patent placement applies. Any step involving electrolysis, an electric, current electroosmosis, electrophoresis, electrostatic field, electrical discharge or magnetic field and also involving a synthetic resin or natural rubber will be proper in Class 204 even when a wave energy step is involved in any part of the process.

588, Hazardous or Toxic Waste Destruction or Containment, appropriate subclasses for the use of wave energy in the destruction of hazardous or toxic waste.

157.2 Isotope separation or enrichment:

This subclass is indented under subclass 157.15. Subject matter involving chemical processes which separate isotopic species from materials containing differing isotopes; or the enrichment of a material in a particular isotope; or the production of an isotopic species; all of said processes brought about by wave energy.

(1) Note. Examples of patents in this subclass are (a) processes for increasing the concentration of deuterium relative to hydrogen in a fluorhydrocarbon; and (b) processes of producing C^{13} by decomposing C_3H_6, said C_3H_6 containing C^{12} and C^{13} by irradiating C_3H_6.

(2) Note. "Enrichment of an isotopic species" refers to increasing the isotope concentration by an exchange process to a level greater than that existing before the exchange.

157.21 Inorganic product produced:

This subclass is indented under subclass 157.2. Subject matter wherein the produce produced is inorganic in nature.

(1) Note. An inorganic compound for purposes of this subclass denotes those compounds which do not meet the definition of organic which is compounds having carbon therein and which are further characterized by the presence in a molecule of (a) two carbon atoms bonded together, or (b) one atom of carbon bonded to at least least one atom of hydrogen or halogen, or (c) one atom of carbon bonded to at least one atom of nitrogen by a single or double bond, with the proviso that hydrocyanic acid, cyanogen, isocyanic acid, cyanamide, cyanogen halides, isothiocyanic acid, and metal carbides are excluded as being organic compounds.

SEE OR SEARCH THIS CLASS, SUBCLASS:

900, through 914 for art collections pertaiving to subclasses 157.15 through 158.21.

SEE OR SEARCH CLASS:

75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Powder Metal Composi-

tions, and Loose Metal Particulate Mixtures, subclasses 122.5+ for radioactive alloys or metallic compositions.

423, Chemistry of Inorganic Compounds, subclasses 2+ for process for chemically treating a mixture to obtain a radioactive inorganic isotope and subclasses 249+ for a radioactive inorganic compound, nonmetallic element or isotope, per se.

157.22 Using laser:

This subclass is indented under subclass 157.21. Subject matter wherein the separation or enrichment is wherein the separation or enrichment is claimed or solely disclosed as being induced by the use of light amplified by stimulated emissions of radiation, i.e., laser.

(1) Note. This area provides for a specific wave energy processs, i.e., laser. In order for a wave energy process to be classified herein as an original, there must be claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not to be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

157.3 Removing a component from normally gaseous mixture:

This subclass is indented under subclass 157.15. Subject matter in which an initial normally gaseous or vaporous mixture is treated by wave energy so as to remove therefrom by a chemical reaction or change to a different chemical form at least one of the components therein, resulting in a heterogeneous composition.

(1) Note. When the recovery of a definite chemical compound or element as a product is claimed, original classification of the patent is in subclass 157.4 or 157.6. However, where the claim does not include the step of separating the modified component, the patent is classified here even though the disclosed intent is to ultimately effect separation of the component.

(2) Note. The mixture need not be entirely gaseous. It may contain entrained solids or liquids. It must however be handled and distributed as a gas and must be in this form at the onset of the treatment.

(3) Note. Methods of purifying a gaseous composition so as to perfect said remaining composition for a particular art use are classified with the art use.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, appropriate subclasses, for processes of purifying a gaseous mixture or separating a constituent therefrom where no chemical reaction is involved in the separation or purification, per se.

423, Chemistry of Inorganic Compounds, subclasses 210+ for processes of purifying a gaseous mixture or separating constituent therefrom involving a chemical reaction where the claim does not include the step of separating the modified component and the appropriate compound subclasses 249 - 658 when the claim does include such step.

157.4 Process of preparing desired inorganic material:

This subclass is indented under subclass 157.15. Subject matter wherein an element of inorganic compound is produced by a chemical reaction brought about by wave energy.

(1) Note. An inorganic compound is one that does not meet the definition of “organic” as elaborated in subclass 157.6.

SEE OR SEARCH THIS CLASS, SUBCLASS:

158.2, for processes of purifying an inorganic substance by removing impurities therefrom using wave energy.

157.41 Using laser:

This subclass is indented under subclass 157.4. Subject matter wherein the chemical reaction is claimed or solely disclosed as being induced by

the use of light amplified by stimulated emissions of radiation, i.e., a laser.

SEE OR SEARCH THIS CLASS, SUBCLASS:

158.2, for processes of purifying an inorganic substance by employing a laser to decompose the organic or inorganic contaminant.

(1) Note. This area provides for a specific wave energy process, i.e., laser. In order for a wave energy process to be classified herein as an original, there must be a claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim specifically recited the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

157.42 Using sonic of ultrasonic energy:

This subclass is indented under subclass 157.4. Subject matter wherein the chemical reaction is either claimed or solely disclosed as being induced or effected by the step of imparting rapid oscillation at a frequency of greater than 10 cycles per second.

(1) Note. Claims drawn merely to "sonic" energy or "ultrasonic energy" are presumed to meet the stated limitations and thus would be classified herein.

(2) Note. This area provides for a specific wave energy process, i.e., sonic or ultrasonic energy. In order for a wave energy process to be classified herein as an original, there must be a claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

157.43 Using microwave energy:

This subclass is indented under subclass 157.4. Subject matter wherein the chemical reaction is claimed or solely disclosed as being induced or effected by a wave having a wavelength between 30,000 nanometers and 1X109 nanometers and which is usually generated by radio frequency power tubes from high-voltage direct current.

(1) Note. Claims drawn merely to "microwave energy" are presumed to meet the stated limitations and thus would be classified herein.

(2) Note. This area provides for a specific wave energy process, i.e. microwave energy. In order for a wave energy process to be classified herein as an original, there must be a claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

157.44 Using ionizing radiation:

This subclass is indented under subclass 157.4. Subject matter wherein the chemical reaction is claimed or solely disclosed as being induced or effected by ionizing radiation.

(1) Note. Included within the term ionizing radiation are X-rays, gamma rays, nuclear particles like protons, fast neutrons, alpha and beta particles, deuterons, fission fragments and the like or high speed accelerated electrons (including electron bombardment).

(2) Note. The radiation proper for this subclass may be obtained from various sources. The following is a list of such possible sources, e.g., including natural radioactive materials, which emit alpha, beta and gamma radiation such as radium and its compounds; from nuclear fission by-products of processes in which atomic power is generated, these

by-products including elements having atomic numbers 30 to 63; from materials made radioactive by exposure to neutron radiation, such as cobalt-60, cesium-37, sodium-24, manganese-56, gadolinium-72, lanthanum-140, etc.; or from operating nuclear reactors including spent fuel elements. The charged particles may be brought to high energy levels by acceleration in devices like cathode ray tubes, Van de Graff generators, resonant cavity accelerators, betatrons, synchrotrons, cyclotrons, and electron accelerators. Suitable accelerated electrons may also be obtained as beta radiation from radioactive isotopes, such as C^{14}, P^{32}, Sr^{90} and tritium. High energy X-ray machines are a source of X-rays as are the bombardments of metal targets, such as gold or tungsten, with high energy electrons.

(3) Note. This area provides for a specific wave energy process, i.e., ionizing radiation. In order for a wave energy process to be classified herein as an original, there must be claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

157.45 Boron, phosphorous or silicon containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the wave energy process of the product contains at least one boron, phosphorus or silicon atom.

(1) Note. Processes for the production of glass and clay analogues are included herein.

157.46 Nitrogen containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the product of said wave energy process contains at least one nitrogen atom.

157.47 Carbon containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the product of said wave energy process contains at least one carbon atom.

(1) Note. Processes for the production of carbon black are included herein.

157.48 Halogen containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the product of said wave energy process contains at least one halogen atom.

(1) Note. Halogen is limited to fluorine, Chlorine, iodine, bromine and astatine.

157.49 Sulfur containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the product of said wave energy contains at least one sulfur atom.

157.5 Oxygen containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the product of said wave energy process contains at least one oxygen atom.

(1) Note. A process for generating oxygen radicals (02) would be classified herein.

157.51 Metal oxide or hydrate thereof:
This subclass is indented under subclass 157.5. Subject matter wherein the product is a binary compound containing only a metal atom and oxygen, or a hydrate form thereof.

(1) Note. Metal is limited to those elements of atomic number 3-4, 11-13, 19-33, 37-51, 55-70, 72-84 or 87 and higher.

157.52 Hydrogen containing product produced:
This subclass is indented under subclass 157.4. Subject matter wherein the product of said wave energy process contains at least one hydrogen atom.

157.6 Process or preparing desired organic product containing at least one atom other than carbon and hydrogen:

This subclass is indented under subclass 157.15. Subject matter wherein a specific organic compound is produced by a chemical reaction brought about by wave energy and wherein said organic compound contains at least one atom other than carbon and hydrogen.

(1) Note. "Organic" denotes all compounds having carbon therein and which are further characterized by the presence in a molecule of (a) two carbon atoms bonded together, or (b) one atom of carbon bonded to at least one atom of hydrogen or halogen, or (c) one atom of carbon to at least one atom of nitrogen by a single or double bond, with the proviso that hydrocyanic acid, cyanogen, isocyanic acid, cyanamide, cyanogen halides, isothiocyanic acid, and metal carbides are excluded as being organic compounds.

(2) Note. Isomerization processes (for example, a change in orientation from a cis to trans form) which are induced by wave energy are classified herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

157.15, for production of an acyclic hydrocarbon and 158.14 for production of a cyclic hyderocarbon.

158.21, for processes of purifying an organic substance by removing impurities therefrom and using wave energy.

157.61 Using laser:

This subclass is indented under subclass 157.6. Subject matter wherein the chemical reaction is claimed or solely disclosed as being induced by the use of light amplified by stimulated emissions of radiation, i.e., a laser.

(1) Note. This area provides for a specific wave energy process, i.e., laser. In order for a wave energy process to be classified herein as an original, there must be a claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

SEE OR SEARCH THIS CLASS, SUBCLASS:

158.21, for processes of purifying an organic substance by photolyzing impurities therefrom by use of a laser.

157.62 Using sonic or ultrasonic energy:

This subclass is indented under subclass 157.6. Subject matter wherein the chemical reaction is claimed or solely disclosed as being induced or effected by the step of imparting rapid oscillation at a frequency of greater than 10 cycles per second.

(1) Note. Claims drawn merely to "sonic" energy or "ultrasonic energy" are presumed to meet the stated limitations and thus would be classified herein.

(2) Note. This area provides for a specific wave energy process, i.e., sonic or ultrasonic. In order for a wave energy process to be classified herein as an original, there must be a claim to the noted process of the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

157.63 Using ionizing radiation:

This subclass is indented under subclass 157.6. Subject matter wherein the chemical reaction is claimed or solely disclosed as being induced or effected by ionizing radiation.

(1) Note. Included within the term ionizing radiation are X-rays, gamma rays, nuclear particles like protons, fast neutrons, alpha and beta particles, deuterons, fission fragments and the like, or high speed accelerated electrons (including electron bombardment).

(2) Note. The radiation proper for this subclass may be obtained from various sources. The following is a list of such possible sources, e.g., including natural radioactive materials, which emit alpha, beta and gamma radiation such as radium and its compounds; from nuclear fission by-products including elements having atomic numbers 30 to 63; from materials made radioactive by exposure to neutron radiation such as cobalt-60, cesium-37, sodium-24, manganese-56. gadolinium-72, lanthanum-140, etc.; or from operating nuclear reactors including particles maybe brought to high energy levels by acceleration in devices like cathode ray tubes,Van de Graff generators, resonant cavity accelerators, betatrons, synchrotrons, cyclotrons, and electron accelerators suitable accelerated electrons may also be obtained as beta radiation from radioactive isotopes, such as C^{14}, P^{32}, Sr^{90} and tritium. High energy X-ray machines are a source of X-rays as are the bombardments of metal targets, such as gold or tungsten, with high energy electrons.

(3) Note. This area provides for a specific wave energy process, i.e., ionizing radiation. In order for a wave energy process to be classified herein as an original, there must be a claim to the noted process or the total disclosure in the patent must be directed to the specific process. The wave energy process in the claim need not be limited to the provided specific process if the claim specifically recites the process of this subclass. Processes not claimed or solely disclosed are classified below on some other aspect.

SEE OR SEARCH THIS CLASS, SUBCLASS:

158.21, for processes of purifying an organic compound by removing impurities therefrom by wave energy wherein said wave energy induces a reaction to occur only amongst the considered material.

157.64 Nitrogen, sulfur, phosphorous or silicon containing product produced:

This subclass is indented under subclass 157.63. Subject matter wherein the product produced from said reaction contains at least one nitrogen, sulfur, phosphorus or silicon atom.

157.65 Carbocyclic ring containing product produced:

This subclass is indented under subclass 157.63. Subject matter wherein the product produced from said reaction contains a ring composed of only carbon and hydrogen atoms.

157.67 Vitamin product produced:

This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process is a vitamin or modified product thereof.

(1) Note. Examples of patents proper for this subclass include: (a) processes of treating an activatable material to impart an antirachitic (vitamin D) property thereto by exposing the same to wave energy; (b) processes of producing or increasing vitamin D in ergosterol by the use of wave energy; (c) processes for the isomerization of cis-vitamin A compound or derivative thereof into the translomer by the use of wave energy.

SEE OR SEARCH THIS CLASS, SUBCLASS:

166, for preparation or treatment of vitamins involving the use of an electrostatic field or electrical discharge.

SEE OR SEARCH CLASS:

424, and 524, Drug, Bio-Affecting and Body Treating Compositions, appropriate subclass, based on the structure of the vitamin and especially Class 514, subclasses 167+ for a vitamin D composition which may be produced by wave energy.

426, Food or Edible Material: Processes, Compositions, and Products, subclasses 72+, 248+ and 311 for food products, containing vitamins and processes involving the same.

157.68 Carbohydrate or protein product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process is either a protein or carbohydrate or modified product thereof.

(1) Note. Included herein as proteins are gelatin and collagen. Included herein as carbohydrates are sugars, cellulose, and starch.

(2) Note. Examples of patents proper for this subclass include: (a) a process of producing saccharose from formaldehyde by use of wave energy; (b) a process of releasing fragments of peptides from a polypeptide by use of photolysis.

(3) Note. The scope of the terms protein and carbohydrate is defined in Class 530, subclass 350 and Class 536, subclasses 1.11+ respectively.

SEE OR SEARCH CLASS:
522, Synthetic Resins or Natural Rubbers, subclasses 87 through 89 for processes of chemically reacting a carbohydrate or protein with an ethylenic reactant by wave energy and modified products thereof.

157.69 Heterocyclic product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process is an organic compound wherein one or more carbon atoms are covalently bonded in a ring system with at least one hetero atom of oxygen, sulfur, nitrogen, selenium or tellurium and there are no other different atoms in the ring.

157.7 Hetero sulfur containing:
This subclass is indented under subclass 157.69. Subject matter wherein there is at least one sulfur atom in the hetero ring system.

157.71 Hetero nitrogen containing:
This subclass is indented under subclass 157.69. Subject matter wherein there is at least one nitrogen atom in the hetero ring system.

157.72 Hetero nitrogen ring contains at least two hetero atoms:
This subclass is indented under subclass 157.71. Subject matter wherein there is at least one nitrogen atom and at least one other atom selected from oxygen, nitrogen, selenium or tellurium in the same hetero ring.

157.73 Phosphorous product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process contains at least one phosphorus atom.

157.74 Silicon product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process contains at least one silicon atom.

157.75 Heavy metal product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process contains a metal having a specific gravity greater than four, including arsenic.

157.76 Sulfur product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the product of the wave energy process contains at least one sulfur atom.

157.77 Nitrogen containing:
This subclass is indented under subclass 157.76. Subject matter wherein the sulfur product produced also contains at least one nitrogen atom.

157.78 Oxygen containing:
This subclass is indented under subclass 157.76. Subject matter wherein the sulfur product produced also contains at least one oxygen atom.

157.79 Halogen containing:
This subclass is indented under subclass 157.78. Subject matter wherein the sulfur and oxygen product produced also contains at least one halogen atom.

(1) Note. Patents with claims drawn to processes of preparing sulfonyl halides or acid halides are included herein.

(2) Note. Halogen is limited to fluorine, chlorine, bromine, iodine and astatine.

157.8 Halogen containing:
This subclass is indented under subclass 157.76. Subject matter wherein the sulfur product produced also contains at least atom selected from fluorine, chlorine, bromine, iodine or astatine.

157.81 Nitrogen product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the produce of the wave energy contains at least one nitrogen atom.

157.82 Oxygen containing:
This subclass is indented under subclass 157.81. Subject matter wherein the product nitrogen produced also contains at least one oxygen atom, e.g., isocyanate, etc.

157.83 Nitroso or oxime containing:
This subclass is indented under subclass 157.82. Subject matter wherein the oxygen atom is part of a C=N.OH or C-N=O group.

157.84 Halogen containing:
This subclass is indented under subclass 157.83. Subject matter wherein the C=N-OH or C-N=O product contains at least one halogen atom.

(1) Note. Halogen is limited to fluorine, chlorine, iodine, bromine and astatine.

157.85 Carbon triple bonded to nitrogen containing:
This subclass is indented under subclass 157.81. Subject matter wherein the nitrogen product produced contains a least one -C=N group.

157.86 Halogen containing:
This subclass is indented under subclass 157.81. Subject matter wherein the nitrogen product produced contains at least one halogen atom.

(1) Note. Halogen is limited to fluorine, chlorine, iodine, bromine and astatine.

157.87 Carboxylic acid or derivative product:
This subclass is indented under subclass 157.6. Subject matter wherein the organic product which is the result of a wave energy process is a carboxylic acid or derivative.

(1) Note. A carboxylic acid for purposes of this subclass denotes:

A compound containing the structure A. --OH

A carboxylic acid derivative for this subclass is limited to ester, nonhetero anhydride, salt, and acyl halide.

A carboxylic acid anhydride denotes:

A compound containing the acyclic structure

B. --O-

A carboxylic acid ester denotes:

A compound containing the structure

C. --O-C

wherein the carbon atom single bonded to the oxygen atom of the

--O- group is not double bonded to oxygen, selenium, or tellurium.

An acid hacioe denotes:

A compound containing the structure

D. --hal

The salt of a carboxylic acid denotes:

A compound containing the structure

E. --

wherein X is a metal

157.88 Oxygen other than as part of a carboxylic acid or derivative moiety:
This subclass is indented under subclass 157.87. Subject matter wherein the carboxylic acid or derivative contains an oxygen atom which is other than as part of a-O or derivative group.

157.89 Atom other than carbon, hydrogen or oxygen:
This subclass is indented under subclass 157.87. Subject matter wherein the carboxylic acid or derivative contains an atom other than carbon, hydrogen or oxygen.

157.9 Alcohol product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the organic product of a wave energy process is an alcohol.

(1) Note. Alcohol denotes a C-OH group wherein the carbon atom bound to the oxygen atom of the hydroxyl group cannot be double bonded to oxygen, selenium or tellurium.

157.91 Fused or bridged ring containing:
This subclass is indented under subclass 157.9. Subject matter wherein the alcohol contains a fused- or bridged-ring system.

(1) Note. A fused- or bridged-ring system for this subclass denotes a ring system having at least two rings which (a) share with each other two adjacent ring atoms, or (b) share with each other three or more ring atoms and wherein each ring having shared atoms is a carbocyclic ring.

157.92 Ether product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the organic product of a wave energy process is a ether.

(1) Note. An ether for purposes of this subclass denotes an organic compound having the general structure-C-O-C- wherein the carbons bound to the linking oxygen atom cannot be double bonded to oxygen, selenium, or tellurium.

157.93 Aldehyde or ketone product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the organic product of a wave energy process is an aldehyde or ketone.

(1) Note. An aldehyde for purposes of this subclass denotes an organic compound containing the structure

R--H

(2) Note. A ketone for purposes of this subclass denotes an organic compound having the general structure

R--R

157.94 Halogen product produced:
This subclass is indented under subclass 157.6. Subject matter wherein the organic product of a wave energy process contains at least one halogen atom.

(1) Note. Halogen is limited to fluorine, chlorine bromine, iodine and astatine.

157.95 Carbon and halogen only in product:
This subclass is indented under subclass 157.94. Subject matter wherein the halogen product produced is composed solely of carbon and halogen atoms.

157.96 Carbocyclic ring containing:
This subclass is indented under subclass 157.95. Subject matter wherein the carbon and halogen product contains at least one ring composed solely of carbon atoms, e.g. aryl, etc.

157.97 Aryl ring containing:
This subclass is indented under subclass 157.96. Subject matter wherein at least one ring is aryl.

157.98 Unsaturated product:
This subclass is indented under subclass 157.94. Subject matter wherein the halogen containing product produced contains an unsaturated group.

(1) Note. The term “unsaturated” includes benzene ring containing compounds.

157.99 Unsaturation in aryl ring:
This subclass is indented under subclass 157.98. Subject matter wherein the unsaturated group is part of an aryl ring.

158.1 Carbocyclic ring containing:
This subclass is indented under subclass 157.94. Subject matter wherein the halogen containing product produced contains a ring composed solely of carbon atoms.

SEE OR SEARCH THIS CLASS, SUBCLASS:
158.1, for a product containing an aryl ring.

158.11 Two or more diverse halogen atoms containing:
This subclass is indented under subclass 157.94. Subject matter wherein the halogens containing product produced contains at least two diverse halogen atoms.

158.12 Four or more carbon atoms containing:
This subclass is indented under subclass 157.94. Subject matter wherein the halogen product produced contains at least four carbon atoms.

158.14 At least one carbocyclic ring and only carbon and hydrogen atoms in product produced:
This subclass is indented under subclass 157.15. Subject matter wherein an organic compound is produced which contains a ring composed solely of carbon atoms and wherein the molecule consists solely of carbon and hydrogen atoms.

158.2 Processes of purifying materials:
This subclass is indented under subclass 157.15. Subject matter involving processes which cause the separation or purification of materials through chemical reactions brought about by wave energy.

(1) Note. Examples of patents proper for this subclass include: (a) processes of removing phosgene impurity in BC13 by the use of laser radiation said radiation disassociating COC12 into disassociated products; (b) processes of subjecting propylene oxide containing volatile by-product chlorine-containing impurities to ionization radiation to remove said impurities; (c) processes of removing phenanthrene from crude anthracene by use of wave energy.

(2) Note. Methods of purifying a composition by wave energy so as perfect said composition for a particular art use are classified with the appropriate art use, e.g., Class 426 if a food, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
157.4, and 158.14, for processes of synthesizing a desired compound by the use of wave energy.

SEE OR SEARCH CLASS:
423, Chemistry of Inorganic Compounds, for processes of purifying an inorganic compound or element wherein no chemical reaction induced by wave energy is involved.

158.21 Organic material purified:
This subclass is indented under subclass 158.2. Subject matter wherein the desired material is an organic compound.

(1) Note. See subclass 157.6 for a definition of the term “organic compound”.

SEE OR SEARCH CLASS:
260, Chemistry of Carbon Compounds, 518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, 530 - 570, Organic Compounds -- Part of the Class 532 - 570 Series, and 585, Chemistry of Hydrocarbon Compounds, for processes of purifying an organic compound by chemical reaction induced by other than wave energy.

164 Chemical processes which have for their purpose the preparation of compounds or elements through chemical reactions brought about by the agency of electrical energy within an electrostatic field or a field within which electrical discharging takes place. For example, the conversion of the surface of a polymeric material to produce a film thereon. This group includes both the synthetic production of compounds or

elements and, likewise the chemical modification or chemical purification of compounds or elements, making use of electrical energy to effect the chemical changes in such processes. The processes falling within this group of subclasses are those whose purpose is for the production of compounds or elements by chemical reaction, but not those wherein a material or composition is treated, such as a metal, tobacco, foods, beverages, leather and the like, and in which a chemical change may be brought about. This group of subclasses likewise includes processes wherein one or both of the reactants are subjected to an electrostatic field or electrical discharge for the purpose of activation and the desired reaction is effected by mere mixing while such reactant or reactants are in the activated condition. This usually consists of a step of ionization followed immediately by mixture with another ionized or unionized substance, the reaction following as a matter of course due to the condition of the mixed reactants.

(1) Note. For chemical processes brought about in a zone wherein both a magnetic field and discharging occurs, see this class, subclass 156.

(2) Note. For electric charge generating or conducting apparatus (ionizing devices) see Class 361, Electricity: Electrical Systems and Devices, subclasses 230+.

SEE OR SEARCH CLASS:

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 186.04+ for corresponding apparatus.

588, Hazardous or Toxic Waste Destruction or Containment, appropriate subclasses for the use of electrostatic field or electrical discharges in the destruction of hazardous or toxic waste.

165 This subclass is indented under subclass 164. Processes directed to the production of organic compounds.

(1) Note. For electrostatic field or electrical discharge processes of producing carbon, see this class, subclass 173.

166 This subclass is indented under subclass 165. Processes directed to the production of vitamins.

(1) Note. Compare with this class, subclass 157.67.

(2) Note. See Class 426, Food or Edible Material: Processes, Compositions, and Products, subclasses 72+, 248 and 311 for food products containing vitamins.

(3) Note. See Class 424, Drug, Bio-Affecting and Body Treating Compositions, appropriate subclass for a composition containing a vitamin and for treating or curing a disease of the body.

167 This subclass is indented under subclass 165. Processes directed to the production and treatment of fats, fatty oils, ester-type waxes, fatty still residues or higher fatty acids.

168 This subclass is indented under subclass 165. Processes directed to the production and treatment of hydrocarbons.

169 This subclass is indented under subclass 168. Processes directed to the production of halogenated or oxidized hydrocarbons.

170 This subclass is indented under subclass 168. Processes directed to the production of gaseous hydrocarbons.

(1) Note. This group of patents is intended to include processes for the production of heating and illuminating gaseous mixtures comprising hydrocarbons when use is made of an electrostatic field or electrical discharge for their preparation. However, those processes are not here included which employ an electrostatic field or electrical discharge as merely one of a series of treatments of hydrocarbons to produce such gases unless the other treatments are in nature of preparatory steps for the electrostatic field or electrical discharge step and are integrally associated therewith.

171 This subclass is indented under subclass 170. Processes directed to the production of acetylene.

172 This subclass is indented under subclass 168. Processes directed to the cracking of hydrocarbon oils.

(1) Note. See this class, subclasses 170 and 171 for cracking processes resulting in the production of gaseous hydrocarbons.

173 This subclass is indented under subclass 164. Processes directed to the production of carbon.

(1) Note. Carbon may be incidentally produced in the processes classified in this class, subclass 165 and indented subclasses.

(2) Note. See 423, Chemistry of Inorganic Compounds, subclasses 445+ for non-electrolytic processes of forming carbon.

174 This subclass is indented under subclass 164. Processes directed to the production of inorganic sulfur-oxygen compounds.

175 This subclass is indented under subclass 164. Processes directed to the production of hydrogen peroxide.

176 This subclass is indented under subclass 164. Processes directed to the production of ozone.

SEE OR SEARCH CLASS:
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 186.07+ for corresponding apparatus.

177 This subclass is indented under subclass 164. Processes directed to the production of inorganic nitrogen compounds.

178 This subclass is indented under subclass 177. Processes where the field employed comprises an electrical arc discharge.

179 This subclass is indented under subclass 178. Processes directed to the production of nitrogen oxides.

(1) Note. This group of patents includes the recovery of the oxides even though this be accomplished by absorption in water or aqueous solutions with the change to the corresponding acid or salt. For example, processes which merely in addition to the arc synthesis of nitrogen oxides include absorption of the oxide (1) in water to form nitric, nitrous or other acid, or (2) in a alkaline solutions to form nitrites, nitrates and the like, are here included.

192.1 Coating, forming or etching by sputtering:
Processes for coating, forming or etching within a vacuum environment involving bombarding a solid or liquid target material with atomic particles (e.g., ions) to cause some target material to be ejected (i.e., sputtered) by momentum transfer.

(1) Note. Solid or liquid material being bombarded is generally referred to as the target material.

(2) Note. Material removed from the target may be used to deposit a coating on a workpiece, to etch a workpiece or to form a product, e.g., particles, flakes, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
298.01, for corresponding apparatus.
471+, for electrophoretic or electro-osmotic coating or forming of an object.

SEE OR SEARCH CLASS:
205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions subclasses 67+ for electroforming or a composition therefor and subclasses 80+ for electrolytic coating.

192.11 Ion beam sputter deposition:
This subclass is indented under subclass 192.1. Processes for the deposition of target material onto a surface (or substrate), to coat or form, wherein a beam of ions generated by an ions source remote from the target is employed to sputter material from the target.

192.12 Glow discharge sputter deposition (e.g., cathode sputtering, etc.):
This subclass is indented under subclass 192.1. Processes for the deposition of target material onto a surface (or substrate) wherein material is sputtered from the target in the presence of a glow discharge, e.g., cathode sputtering, etc.

192.13 Measuring or testing (e.g., of operating parameters, property of articles, etc.):
This subclass is indented under subclass 192.12. Processes wherein at least one characteristic of the process or the product produced is measured or tested.

192.14 Coating inorganic material onto polymeric material:
This subclass is indented under subclass 192.12. Processes wherein inorganic coating material is deposited onto a polymeric material.

192.15 Specified deposition material or use:
This subclass is indented under subclass 192.12. Processes wherein the target or deposition material has a designated chemical composition or the function of the product is specified.

(1) Note. A designated chemical composition (DCC) is a composition wherein at least one chemical atom is identified. for a more comprehensive definition of DCC, see DEFINITIONS OF TERMS, under the main definitions of this class.

192.16 Wear or abrasion resistant:
This subclass is indented under subclass 192.15. Processes wherein the function of the coating is to enhance the wear or abrasion resistance of the product.

192.17 Electrical contact material:
This subclass is indented under subclass 192.15. Processes wherein the material functions as an electrical contact or electrode.

192.18 This subclass is indented under subclass 192.15. Process wherein the material exhibits piezoelectric properties (e.g., conversion of applied voltage to physical motion).

(1) Note. This subclass includes ferroelectic materials, i.e., wherein the coating is characterized by spontaneous electric polarization the direction of which can be altered by an electric field. These materials are dielectric analogs of ferromagnetic materials.

192.2 Ferromagnetic:
This subclass is indented under subclass 192.15. Processes wherein the material exhibits ferromagnetic properties (e.g., hysteresis, etc.).

192.21 Resistor:
This subclass is indented under subclass 192.15. Processes wherein the deposition material is characterized by a specified electrical resistivity and is adapted to function as a resistor in an electrical circuit.

192.22 Insulator or dielectric:
This subclass is indented under subclass 192.15. Processes wherein the material is characterized by low electrical conductivity.

192.23 Silicon containing:
This subclass is indented under subclass 192.22. Processes wherein the material comprises silicon.

192.24 Superconductor:
This subclass is indented under subclass 192.15. Processes wherein the material is characterized by an almost complete disappearance of electrical resistance at low temperatures.

192.25 Semiconductor:
This subclass is indented under subclass 192.15. Processes wherein the material is a semiconductor.

SEE OR SEARCH CLASS:
438, Semiconductor Device Manufacturing: Process, for (a) combined processes and (b) certain unit operations of manufacturing a semiconductive substrate or device.

192.26 Optical or photoactive:
This subclass is indented under subclass 192.15. Processes wherein the material is chosen on the basis of its optical properties or wherein a property of the material is altered in the presence of light (e.g., photoconductive, etc.).

192.27 Reflective:
This subclass is indented under subclass 192.26. Processes wherein the function of the material is to reflect at least a part of the spectrum of visible light (e.g., coated glass for architectural applications).

192.28 Absorptive:
This subclass is indented under subclass 192.26. Processes wherein the function of the material is to absorb at least part of the spectrum of visible light (e.g., coated panels for collecting solar energy).

192.29 This subclass is indented under subclass 192.26. Processes wherein the material is electrically conductive and transparent to light.

192.3 With sputter etching:
This subclass is indented under subclass 192.15. Processes wherein a sputter etching step is included in the process in addition to the sputter deposition step.

192.32 Sputter etching:
This subclass is indented under subclass 192.1. Processes for removing materials from a substrate wherein the substrate is subjected to bombardment by atomic particles (e.g., ions) and the activation energy is supplied at least in part by momentum transfer.

SEE OR SEARCH CLASS:
438, Semiconductor Device Manufacturing: Process, subclasses 707+ for processes of vapor phase chemical etching of a semiconductive substrate utilizing irradiation of electromagnetic or wave energy and, particularly, subclasses 710+ for such chemical etching processes wherein the irradiation produces a plasma or glow discharge.

192.33 Measuring or treating (e.g., operating parameters, end point determination etc.):
This subclass is indented under subclass 192.32. Processes wherein at least one characteristic of the etching process or the substrate being etched is measured or tested, e.g., operating parameters, and point determination, etc.

192.34 Ion beam etching (e.g., ion milling, etc.):
This subclass is indented under subclass 192.32. Processes wherein a beam of ions generated by an ion source remote from the substrate is employed to sputter material from the substrate.

192.35 Etching specified materials:
This subclass is indented under subclass 192.32. Processes wherein the material being etched comprises a designated chemical composition (DCC).

192.36 Organic:
This subclass is indented under subclass 192.35. Processes wherein the material being etched is organic material.

192.37 Silicon containing:
This subclass is indented under subclass 192.35. Processes wherein the material being etched is organic material.

192.38 Vacuum arc discharged coating:
Processes for the deposition of a coating onto a substrate within a vacuum environment by the action of an arc discharge between an anode and a cathode wherein the source of material to be deposited forms or is associated with the cathode.

(1) Note. The process is generally characterized by one or more cathode spots which move across the surface of the source and vaporize the coating materials.

193 Apparatus specialized for carrying out any of the processes of this class and not provided for in subclasses indented hereunder.

194 This subclass is indented under the class definition. Apparatus for performing electrolytic operations coming .

196.01 Object protection:

This subclass is indented under subclass 194. Apparatus having means for utilizing an electrolytic current or potential (a) to prevent corrosion, scale formation, or other objectionable action in or on a solid object or (b) to neutralize, correct, or reverse corrosion, scale formation, or other objectionable action that occurs when a solid object is in normal use.

(1) Note. This subclass and the subclasses indented hereunder are not intended to include apparatus for electrolytic treatment of fluids (e.g., so that the fluids do not cause or accelerate electrolytic action during subsequent use, etc.). Apparatus of this type is classified in another appropriate subclass or subclasses of this class based on the apparatus structure or character.

(2) Note. Combinations of electrolytic object protection means as defined in this subclass with diverse art devices (i.e., per se means classifiable in another class) are provided for in this subclass and the subclasses indented hereunder when no more of the diverse art device is specified than is necessary to provide a setting or locus for the object protection means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

155+, for chemical preparation of a desired chemical compound or element by using electrical or wave energy in a magnetic field (other than (1) electrolysis as provided for in Class 205 or (2) preparation in which a chemical reaction is brought about by the mere heating effect of the electrical or wave energy), including object protection.

SEE OR SEARCH CLASS:

136, Batteries, Thermoelectric and Photoelectric, subclasses 200+ for thermoelectric batteries and subclasses 243+ for photoelectric batteries.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 724+ for an electrolytic process of protecting a metal or metal alloy object.

307, Electrical Transmission or Interconnection Systems, subclass 95 for electrical systems having means to prevent electrolysis as a result of the operation of such systems.

361, Electricity: Electrical Systems and Devices, subclasses 230+ for ionization apparatus, in general, and subclasses 500+ for electrolytic apparatus which is utilized for a purpose other than to (1) produce a desired chemical change or (2) protect an object by use of an electrolytic current or potential.

392, Electric Resistance Heating Devices, subclass 457 for a line connected tank type liquid heater with an immersion heating element and with means protecting against galvanic corrosion where (1) the protecting means is nonelectrolytic in nature or (2) there is more of the heater specified than is necessary to provide a setting or locus for the protection means.

429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, for an electrolyte, process, or apparatus specialized for generation or production of an electrical current as a result of a chemical reaction or change in physical state (e.g., from liquid to gas, etc.).

196.02 With control means responsive to sensed condition:

This subclass is indented under subclass 196.01. Apparatus including means for detecting an apparatus or process characteristic or a change therein and for controlling (i.e., regulating) operation of the apparatus or process based on the detected characteristic or change therein.

(1) Note. In this subclass and the subclasses indented hereunder, a single means may be used both to detect a characteristic or change therein and to implement an action based upon the detected characteristic or change therein. There must be

a positive action implemented by a control means as a result of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.06+, for electrolytic object protection apparatus with measuring, testing, or sensing means but without control means responsive to a sensed condition.

228.1+, for other electrolytic apparatus with current, voltage, or power control means responsive to a sensed condition.

230.2+, for electrolytic apparatus with other current, voltage, or power control means.

400+, for an apparatus which performs electrolytic analysis or testing, per se.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also (3) Note in the class definition of class 73 for additional loci of other measuring and testing processes and apparatus.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 725+ for an electrolytic process of protecting a metal or metal alloy object with control responsive to a sensed condition.

323, Electricity: Power Supply, or Regulation Systems, subclasses 220 through 354 for systems controlling current and/or voltage in a single circuit.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even if nonelectrical values are derived from the electrical properties determined.

196.03 And programmed, cyclic, or time responsive control means:

This subclass is indented under subclass 196.02. Apparatus also having control means for (a) storing coded instructions or other data used to regulate operation of the apparatus, (b) repetitively regulating a sequence of operational steps performed in or by the apparatus, or (c) causing various operations to occur according to preset timing sequences or to last for predetermined durations (e.g., timer switches, etc.).

(1) Note. This subclass is not intended to provide for apparatus merely using alternating current (AC), per se.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.05, for electrolytic object protection apparatus with programmed, cyclic, or time responsive control means but without control means responsive to a sensed condition.

229.2+, for other electrolytic apparatus with current, voltage, or power control means responsive to a sensed condition and with programmed, cyclic, or time responsive control means.

229.4+, for other electrolytic apparatus with programmed, cyclic, or time responsive control means but without control means responsive to a sensed condition.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclass 728 for an electrolytic process of protecting a metal or metal alloy object with control responsive to a sensed voltage and with programmed, cyclic, or time responsive control and subclass 729 for an electrolytic process of protecting a metal or metal alloy object with programmed, cyclic, or time responsive control but without control responsive to a sensed condition.

196.04 Internal battery:

This subclass is indented under subclass 196.02. Apparatus having an internal power supply (i.e., a power supply integral with the apparatus).

(1) Note. This subclass provides for electrolytic object protection apparatus in which current is derived from an internal chemical reaction (e.g., galvanic cell,

protection apparatus with a sacrificial anode, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.07, for internal battery electrolytic object protection apparatus with measuring, testing, or sensing means but without control means responsive to a sensed condition and without programmed, cyclic, or time responsive control means.

196.1+, for other internal battery electrolytic object protection apparatus.

248+, for other internal battery electrolytic cells.

SEE OR SEARCH CLASS:

136, Batteries: Thermoelectric and Photoelectric, subclasses 200+ for thermoelectric batteries and subclasses 243+ for photoelectric batteries.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 730+ for an electrolytic process of protecting a metal or metal alloy object by internal battery action.

429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, for an electrolyte, process, or apparatus specialized for generation or production of an electrical current as a result of a chemical reaction or change in physical state (e.g., from liquid to gas, etc.).

196.05 With programmed, cyclic, or time responsive control means:

This subclass is indented under subclass 196.01. Apparatus having control means for (a) storing coded instructions or other data used to regulate operation of the apparatus, (b) repetitively regulating a sequence of operational steps performed in or by the apparatus, or (c) causing various operations to occur according to preset timing sequences or to last for predetermined durations (e.g., timer switches, etc.).

(1) Note. This subclass does not provide for control means directly responsive to a sensed condition but includes a control means which maintains an operating condition, predetermines apparatus operation, or regulates repetition.

(2) Note. This subclass is not intended to provide for apparatus merely using alternating current (AC), per se.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.03, for electrolytic object protection apparatus with control means responsive to a sensed condition and with programmed, cyclic, or time responsive control means.

229.2+, for other electrolytic apparatus with current, voltage, or power control means responsive to a sensed condition and with programmed, cyclic, or time responsive control means.

229.4+, for other electrolytic apparatus with programmed, cyclic, or time responsive current, voltage, or power control means but without current, voltage, or power control means responsive to a sensed condition.

230.2+, for electrolytic apparatus with other current, voltage, or power control means.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclass 728 for an electrolytic process of protecting a metal or metal alloy object with control responsive to a sensed voltage and with programmed, cyclic, or time responsive control and subclass 729 for an electrolytic process of protecting a metal or metal alloy object with programmed, cyclic, or time responsive control but without control responsive to a sensed condition.

196.06 With measuring, testing, or sensing means:

This subclass is indented under subclass 196.01. Apparatus having measuring, detecting, or testing means for a characteristic, condition, or property of the apparatus or an element associated with the apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.02+, for electrolytic object protection apparatus with control means responsive to a sensed condition.

229.8+, for other electrolytic apparatus with means for measuring, testing, or sensing current, voltage, or power.

400+, for electrolytic analysis or testing apparatus, per se.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also (3) Note in the class definition of class 73 for additional loci of other measuring and testing processes and apparatus.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 775+ for a process of electrolytic analysis or testing, per se.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even if nonelectrical values are derived from the electrical properties determined.

196.07 Internal battery:

This subclass is indented under subclass 196.06. Apparatus having an internal power supply (i.e., a power supply integral with the apparatus).

(1) Note. This subclass provides for electrolytic object protection apparatus in which current is derived from an internal chemical reaction (e.g., galvanic cell, protection apparatus with a sacrificial anode, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.04, for internal battery electrolytic object protection apparatus with control means responsive to a sensed condition but without programmed, cyclic, or time responsive control means.

196.1+, for other internal battery electrolytic object protection apparatus.

248+, for other internal battery electrolytic cells.

SEE OR SEARCH CLASS:

136, Batteries: Thermoelectric and Photoelectric, subclasses 200+ for thermoelectric batteries and subclasses 243+ for photoelectric batteries.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 730+ for an electrolytic process of protecting a metal or metal alloy object by internal battery action.

429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, for an electrolyte, process, or apparatus specialized for generation or production of an electrical current as a result of a chemical reaction or change in physical state (e.g., from liquid to gas, etc.).

196.08 With gas or vapor removing or treating means:

This subclass is indented under subclass 196.01. Apparatus having means for exhausting, separating, or otherwise treating a gas or vapor.

(1) Note. This subclass is intended to provide for means suited to minimize or alter an effect of the gas or vapor on the apparatus. The removing or treating means may be as simple as a vent on top of a closed vessel to allow dispersion of an unwanted gas or vapor into a surrounding atmosphere. However, the removing or treating means may be equipped to perform a chemical reaction to combine gaseous hydrogen and oxygen (generated during electrolysis) into water (vapor or liquid) by contact with a suitable catalyst.

SEE OR SEARCH THIS CLASS, SUBCLASS:

232+, for other electrolytic cells with electrolyte treatment means.

245+, 255+, 257+, 263+, 269+, and 275+ for other electrolytic cells with feeding and/or withdrawal means, including addition or removal of a gas or vapor.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, as the residual class for gas separation apparatus. See the Class 96 definition for an elaboration of class lines with other classes providing for gas separation apparatus.

196.09 Plural cells used or protected:

This subclass is indented under subclass 196.01. Apparatus having two or more distinct cell units for object protection or means for protecting two or more distinct cell units.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244, 253+, and 267+ for other electrolytic apparatus with plural cells.

196.1 Internal battery:

This subclass is indented under subclass 196.01. Apparatus having an internal power supply (i.e., a power supply integral with the apparatus).

(1) Note. This subclass provides for electrolytic object protection apparatus in which current is derived from an internal chemical reaction (e.g., galvanic cell, protection apparatus with a sacrificial anode, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.04, for internal battery electrolytic object protection apparatus with control means responsive to a sensed condition but without programmed, cyclic, or time responsive control means.

196.07, for internal battery electrolytic object protection apparatus with measuring, testing, or sensing means.

248+, for other internal battery electrolytic cells.

SEE OR SEARCH CLASS:

136, Batteries: Thermoelectric and Photoelectric, subclasses 200+ for thermoelectric batteries and subclasses 243+ for photoelectric batteries.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 730+ for an electrolytic process of protecting a metal or metal alloy object by internal battery action.

429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, for an electrolyte, process, or apparatus specialized for generation or production of an electrical current as a result of a chemical reaction or change in physical state (e.g., from liquid to gas, etc.).

196.11 Resistor or impedance in series between anode and object:

This subclass is indented under subclass 196.1. Apparatus having an element or device which imposes a specified or expressly stated opposition to electrolytic current and is positioned in series between a positive electrode and the protected object.

(1) Note. For the purposes of this subclass, the claimed disclosure must specify inclusion of a resistor or impedance in series between an anode and the protected object.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.26, for an electrolytic object protection apparatus with a resistor or impedance in series between the object and a power supply but without internal battery means.

196.12 With fluid filter:

This subclass is indented under subclass 196.1. Apparatus having a foraminous or porous mass to trap one or more constituents while allowing remaining fluid to pass therethrough.

(1) Note. A fluid filter for this subclass may also be electrically charged (i.e., as an electrode) to preferentially attract one or more fluid constituents, provided that entrapment (e.g., physical removal, etc.) also occurs at the filter.

196.13 With bypass means:

This subclass is indented under subclass 196.1. Apparatus having means for redirecting fluid flow.

(1) Note. This subclass provides for internal battery object protection apparatus with a bypass valve which facilitates removal or replacement of a positive electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.14, for an internal battery electrolytic object protection apparatus with a moving anode.

196.15, for an internal battery electrolytic object protection apparatus with an inlet or outlet means but without a bypass valve.

196.28, for an electrolytic object protection apparatus with a rotating electrode but without internal battery means.

196.14 Anode moving relative to object:

This subclass is indented under subclass 196.1. Apparatus having means for changing position or orientation of a positive electrode with respect to the object (e.g., loosely stacked anode elements vibrating during electrolytic protection of a fixed object, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.13, for an internal battery electrolytic object protection apparatus with a bypass means.

196.17+, for an internal battery electrolytic object protection apparatus with a rigid anode held by a rigid support.

196.28, for other electrolytic object protection apparatus with a rotating electrode.

196.15 With fluid inlet or outlet means used or protected:

This subclass is indented under subclass 196.1. Apparatus having at least one inlet or outlet or means for protecting an object having at least one inlet or outlet (e.g., object is a fluid heat exchanger or object protection means is a simple fluid pipe which may or may not be connected to a tank or vessel, etc.).

(1) Note. This subclass and the subclass indented hereunder are not intended to provide for an object protection means having a perforated anode unless the apparatus encloses at least a portion of the object and thereby forms inlet or outlet means for a fluid. The terms "inlet" and "outlet" find their meaning when applied to one or more openings in an apparatus which surrounds or contains an internal space (for holding or passing a gaseous or liquid medium) as would be the case with a vessel or pipe.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.13, for an internal battery electrolytic object protection apparatus with a bypass valve.

196.16 Dielectric coating, casing, or section:

This subclass is indented under subclass 196.15. Apparatus having an electrically insulating coating, casing, or section (e.g., solid dielectric joins conductor or electrode sections into a rigid unit or provides a protective barrier against corrosion, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.19, for an internal battery electrolytic object protection apparatus with an insulator coating, covering, or shield on or around a rigid anode held by a rigid support but without providing inlet or outlet means for a fluid.

196.32, for an electrolytic object protection apparatus with a rigid anode held by a rigid support, at least one of which is provided with a threaded coupling having insulated threads but without providing inlet or outlet means for a fluid.

196.17 Rigid anode with rigid support:

This subclass is indented under subclass 196.1. Apparatus having at least one stiff and relatively unyielding positive electrode held in place by another means which is also stiff and unyielding in order to hold flexing of the positive electrode to a minimum (e.g., rigid magnesium anode block bolted directly to a steel ship

hull to protect the hull from excessive corrosion in sea water, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.14, for an internal battery electrolytic object protection apparatus with a moving anode.

196.3+, for an electrolytic object protection apparatus with a rigid anode held by a rigid support but without internal battery means.

196.18 More than half of anode is or has coating, covering, or shield:

This subclass is indented under subclass 196.17. Apparatus having a positive electrode serving as or provided with a coated layer, a surrounding mass, or a protective solid barrier in which either (1) more than half of the positive electrode is coated, covered, or shielded or (2) more than half the positive electrode functions as a coating, covering, or shield (e.g., particulate anode covered or shielded by a perforated support housing or canister, anode comprises a strong steel core which is encapsulated by a magnesium coating, etc.).

196.19 Dielectric coating, covering, or shield:

This subclass is indented under subclass 196.18. Apparatus having an electrically insulating coating, covering, or shield

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.16, for an internal battery electrolytic object protection apparatus with a fluid inlet or outlet means used or protected and having a dielectric coating, casing, or section.

196.32, for an electrolytic object protection apparatus with a rigid anode held by a rigid support and having a threaded coupling with dielectric threads but without internal battery means.

196.2 Flexible cable, chain, or wire anode or support:

This subclass is indented under subclass 196.1. Apparatus having a positive electrode constructed of or supported by a flexible cable, chain, or wire (e.g., multiple anode sections mounted along a hanging chain for support, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.33+, for an electrolytic object protection apparatus with a flexible cable, chain, or wire anode or support but without internal battery means.

196.21 Earth grounded object or protection means:

This subclass is indented under subclass 196.1. Apparatus which is or protects an object which is electrically grounded to earth, positioned underground, or at least partly submerged in ground water (e.g., protection means is standing on ground outside, object is subsurface pipeline, object is a ship hull in an ocean, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.36, for an electrolytic object protection apparatus which is earth grounded or is used to protect an earth grounded object but without internal battery means.

196.22 Copper and zinc electrically coupled or alloyed into one or more electrodes:

This subclass is indented under subclass 196.1. Apparatus having one or more electrodes containing copper (Cu) and zinc (Zn) either incorporated into one or more alloys or as electrically coupled free metals or one or more alloys thereof such that at least one electrical contact exists between elemental copper and zinc, alloys thereof, or an alloy of copper and zinc which is in electrical contact with another metal or alloy (e.g., brass in electrical contact with iron, copper in electrical contact with zinc, etc.).

196.23 Anode contains aluminum:

This subclass is indented under subclass 196.1. Apparatus having a positive electrode containing aluminum (Al) (e.g., aluminum free metal or aluminum containing alloy, etc.).

196.24 And magnesium:

This subclass is indented under subclass 196.23. Apparatus having the positive electrode also containing magnesium (Mg) (e.g., magnesium free metal or magnesium containing alloy, etc.).

196.25 And zinc:
This subclass is indented under subclass 196.23. Apparatus having the positive electrode also containing zinc (Zn) (e.g., zinc free metal or zinc containing alloy, etc.).

196.26 Resistor or impedance in series between power supply and object:
This subclass is indented under subclass 196.01. Apparatus having an element or device which imposes a specified or expressly stated opposition to electrolytic current and is positioned in series between a power supply and the protected object.

(1) Note. For the purposes of this subclass, the claimed disclosure must specify inclusion of a resistor or impedance in series between a power source and the protected object. The resistor or impedance may be located inside a "power supply" box as long as it is positioned in a series power circuit and limits electrolytic current.

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.11, for an internal battery electrolytic object protection apparatus with a resistor or impedance in series between an anode and the object.

196.27 Alternative energy supply (e.g., solar panel, thermoelectric or piezoelectric power supply, etc.):
This subclass is indented under subclass 196.01. Apparatus having a power supply for electrolytic current other than an electric battery (wet or dry cell), an electrolytic fuel cell, or an electric dynamo or generator turned by heated fluid from a boiler fired by fossil fuel (e.g., solar panel, thermoelectric or piezoelectric power supply, etc.).

(1) Note. This subclass is intended to provide for an electrolytic object protection apparatus in which electrolytic current is supplied (at least in part) by an energy conversion device other than those commonly used in this art. Placement in this subclass is limited to cases in which an alternative energy supply is clearly specified in the claimed disclosure.

196.28 Rotating electrode:
This subclass is indented under subclass 196.01. Apparatus having means to turn an electrode, including the object or a portion thereof, through at least one complete revolution (360 o) during electrolytic object protection.

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.14, for an internal battery electrolytic object protection apparatus with an anode moving relative to object.
196.3+, for an electrolytic object protection apparatus with a rigid anode held by a rigid support.

196.29 Magnetic mounting means:
This subclass is indented under subclass 196.01. Apparatus held or supported (e.g., on the object, etc.), at least in part, by magnetic force.

196.3 Rigid anode with rigid support:
This subclass is indented under subclass 196.01. Apparatus having a stiff and relatively unyielding positive electrode held in place by a means which is also stiff and unyielding in order to hold flexing of the positive electrode to a minimum (e.g., rigid anode block held by an insulated spacer and insulated bolts to a steel ship hull (connected to a power supply as a cathode) to protect the hull from excessive corrosion in sea water, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.17+, for an internal battery electrolytic object protection apparatus with a rigid anode held by a rigid support.
196.28, for an electrolytic object protection apparatus with a rotating electrode.

196.31 Threaded coupling for rigid anode or rigid support:
This subclass is indented under subclass 196.3. Apparatus in which the positive electrode or support therefor has a threaded coupling (e.g., to allow relatively easy removal or installation of the rigid anode or its rigid support, etc.).

196.32 Dielectric thread:
This subclass is indented under subclass 196.31. Apparatus having at least a portion of a threaded surface on the coupling composed of or coated by an electrical insulator.

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.16, for an internal battery electrolytic object protection apparatus with a dielectric coating, casing, or section and with an inlet or outlet means for fluid.
196.19, for an internal battery electrolytic object protection apparatus with a dielectric coating, covering, or shield on or around a rigid anode held by a rigid support.

196.33 Flexible cable, chain, or wire anode or support:
This subclass is indented under subclass 196.01. Apparatus having a positive electrode constructed of or supported by a flexible cable, chain, or wire (e.g., an anode section mounted at the end of a hanging cable for support, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.2, for an internal battery electrolyctic object protection apparatus with a flexible cable, chain, or wire amode or support.

196.34 Plural anode sections on single cable, chain, or wire:
This subclass is indented under subclass 196.33. Apparatus having a unitary cable, chain, or wire to link and support two or more positive electrode sections to each other (e.g., multiple anode sections mounted for support along a hanging chain, etc.).

(1) Note. For the purposes of this subclass and the subclass indented hereunder, multiple sections of cable, chain, or wire joined end-to-end are considered to function as a single unit.

196.35 Helically wound:
This subclass is indented under subclass 196.34. Apparatus having the cable, chain, or wire wound as a helix or spiral (e.g., cable anode attached in a spiral shape around metal pipe to protect the pipe from corrosion, two wires supporting plural attached anode sections are helically wound around a movable rod suspended down into sea water from dock to protect the dock from corrosion, etc.).

196.36 Earth grounded object or protection means:
This subclass is indented under subclass 196.01. Apparatus which is or protects an object which is electrically grounded, positioned underground, or at least partly submerged in water (e.g., object is standing on ground outside, object is a ship hull in an ocean, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.21, for an internal battery electrolytic object protection apparatus which is earth grounded or is used to protect an earth grounded object.

196.37 Vessel protected (e.g., steam boiler, etc.):
This subclass is indented under subclass 196.01. Apparatus having means to protect a container (as the object) for solid or fluid material (e.g., steam boiler, etc.).

196.38 Anode contains precious metal or free carbon:
This subclass is indented under subclass 196.01. Apparatus having a positive electrode containing a precious metal or free carbon (C).

(1) See section II. GLOSSARY in the class definition of this class for a list of precious metals.

198 Electrolytic apparatus in which means are provided for conveying in the electrolytic bath the article, material or work being treated, such work acting as one of the electrodes.

199 This subclass is indented under subclass 198. Conveyors which give the articles a rotary movement through the bath.

200 This subclass is indented under subclass 199. Rotary conveyors with means to give the electrode base a treatment preliminary or subsequent to the electrolysis.

(1) Note. For endless conveying means combined with base treatment means, see this class, subclasses 203 and 204.

201 This subclass is indented under subclass 199. Rotary conveyors specialized to convey articles in a loose condition within the electrolytic bath, that is, the articles are not fixed to a support while being treated.

202 This subclass is indented under subclass 198. Apparatus in which the conveyor is of the endless type.

203 This subclass is indented under subclass 202. Apparatus with additional means to treat the base before or after the electrolytic action.

(1) Note. For rotary conveying means combined with base treatment means, see this class, subclass 200.

204 This subclass is indented under subclass 203. Apparatus in which is included control means for the current supplied to the electrolytic device, or electrical control for operation of apparatus included or combined with said device.

(1) Note. This subclass does not include a mere current supply.

205 This subclass is indented under subclass 202. Apparatus in which a means is included for the control of current supplied to the electrolytic device or to a device included or combined therewith.

(1) Note. Search also this class, subclass 204.

206 Electrolytic apparatus in which the electrode is moved in the form of a strip or filament of continuous or indefinite length.

207 This subclass is indented under subclass 206. Apparatus which additional means to treat the base before or after the electrolytic action.

208 This subclass is indented under subclass 207. Apparatus wherein stripping means or means to assist stripping are included.

209 This subclass is indented under subclass 207. Apparatus wherein means for mechanically working the base are included.

210 This subclass is indented under subclass 207. Apparatus wherein a means for heat treating the base is included.

211 This subclass is indented under subclass 206. Apparatus including means to control the current supplied to the electrolytic device or to a device included or combined therewith.

212 Electrolytic apparatus which is adapted to give the electrode a rotary motion of more than 180 degrees.

(1) Note. See this class, subclass 199 and indented subclasses, for rotary work conveyors.

213 This subclass is indented under subclass 212. Apparatus falling in which the means to give the rotary motion is a barrel or other rotary receptacle.

SEE OR SEARCH CLASS:
451, Abrading, subclasses 85+ for a sand-blast machine having a tumbling barrel and subclasses 326+ for an abrading machine which involves a tumbling device.

214 This subclass is indented under subclass 213. Apparatus in which means are provided to swing or tilt the axis of the barrel or other rotary receptacle, usually to assist charging or discharging.

215 This subclass is indented under subclass 212. Apparatus in which the base is given an additional treatment before or after the electrolytic action.

216 This subclass is indented under subclass 215. Apparatus wherein stripping means are included.

217 This subclass is indented under subclass 215. Apparatus in which means are included to give the base a mechanical working.

218 This subclass is indented under subclass 212. Apparatus including control means for the current supplied to the electrolytic device or electrical control for operation of apparatus included or combined with said device.

219 Electrolytic apparatus which includes means to move a liquid electrode.

(1) Note. For other cells with liquid electrodes, see this class, subclasses 250 and 251.

220 This subclass is indented under subclass 219. Apparatus including means to recirculate the liquid electrode.

221 This subclass is indented under subclass 219. Apparatus including means to oscillate, reciprocate or agitate the liquid electrode.

222 Electrolytic apparatus which provides means to oscillate, reciprocate or agitate the electrodes.

(1) Note. See this class, subclass 221 for liquid electrodes having means to oscillate, reciprocate or agitate the electrodes.

223 This subclass is indented under subclass 222. Apparatus including control means for the current supplied to the electrolytic device, or electrical control for operation of apparatus included or combined with said device.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous systems for controlling the current and/or voltage in a single circuit.

224 Electrolytic apparatus wherein means are provided to localize the areas to which electrolysis is applied.

(1) Note. This group of patents include portable coating electrodes, cells and half-cells specialized for localized application of the electrolytic coat; however, the subclass is not limited thereto but includes stationary devices in which the electrode or electrodes alone are moved to localize electrolytic action.

(2) Note. Compare with this class, subclass 271.

225 Electrolytic apparatus wherein means are provided whereby an electrode may be fed to and/or withdrawn from the zone of electrolytic action and not falling within the subclasses above.

226 This subclass is indented under subclass 225. Apparatus in which the base is given an additional treatment before or after the electrolytic action.

227 This subclass is indented under subclass 194. Apparatus including an electrolytic cell and means to treat the base before or after the electrolytic action.

(1) Note. Search also this class, subclasses 200, 203, 204, 207-210, 215-217, and 226.

228.1 With current, voltage, or power control means responsive to sensed condition:
This subclass is indented under subclass 194. Apparatus having means for detecting an apparatus or process characteristic or a change therein and for controlling (i.e., regulating) current, voltage, or power based on the detected characteristic or change therein.

(1) Note. In this subclass and the subclasses indented hereunder, a single means may be used both to detect a characteristic or change therein and to implement an action based upon the detected characteristic or change therein. There must be a positive action implemented by a control means as a result of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.02+, for electrolytic object protection apparatus with control means responsive to a sensed condition.

204, 205, 211, 218, and 223, for electrolytic apparatus with movable elec-

trode means and with means to control electrolytic current.

602, 607, and 628, for electrophoretic or electro-osmotic apparatus with control means responsive to a sensed condition.

661+, for apparatus for electrical (including simultaneous electrical and magnetic) separation or purification of a liquid or magnetic treatment of a liquid (other than separation) with control means responsive to a sensed condition.

400+, for apparatus for electrolytic analysis or testing, per se.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also (3) Note in the class definition of class 73 for additional loci of other measuring and testing processes and apparatus.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 82+ for an electrolytic coating process which involves controlling the process in response to a measured or detected parameter, subclasses 641+ for an electrolytic erosion process with control responsive to a sensed condition, and subclasses 725+ and 743 for an electrolytic material treatment process with control responsive to a sensed condition.

323, Electricity: Power Supply or Regulation Systems, , subclasses 220 through 354 for systems controlling current and/or voltage in a single circuit.

324, Electricity: Measuring and Testing, for measuring and testing per se, to determine electrical properties by electrical means even if nonelectrical values are derived from the electrical properties determined.

228.2 Fluid level sensing means:
This subclass is indented under subclass 228.1.
Apparatus having means for sensing level of a fluid.

228.3 Fluid flow sensing means:
This subclass is indented under subclass 228.1.
Apparatus having means for sensing flow of a fluid.

228.4 Fluid pressure sensing means:
This subclass is indented under subclass 228.1.
Apparatus having means for sensing pressure of a fluid.

228.5 Gaseous fluid:
This subclass is indented under subclass 228.4.
Apparatus having means for sensing pressure of a gas or vapor.

228.6 Electrolyte property sensing means (e.g., temperature, concentration, pH, conductivity, etc.):
This subclass is indented under subclass 228.1.
Apparatus having means for sensing an electrolyte property (e.g., temperature, concentration, pH, conductivity, etc.).

228.7 Workpiece property sensing means (e.g., mass, coating thickness, etc.):
This subclass is indented under subclass 228.1.
Apparatus having means for sensing a workpiece property (e.g., mass, coating thickness, etc.).

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclass 84 for an electrolytic coating process which involves controlling the process in response to a measured or detected value for thickness, weight, or composition of the coating.

228.8 Workpiece presence, position, or movement sensing means:
This subclass is indented under subclass 228.1.
Apparatus having means for sensing presence, position, or movement of a workpiece.

228.9 Having auxiliary electrode:
This subclass is indented under subclass 228.1.
Apparatus having another electrode in addition to at least one working electrode and at least one counter electrode.

229.1 Reference electrode as or with auxiliary electrode:

This subclass is indented under subclass 228.9.
Apparatus having a reference electrode as or in addition to the auxiliary electrode.

(1) Note. This subclass includes an apparatus having only 3 electrodes in which the auxiliary electrode serves as a reference electrode. Also included is a combination of a working electrode, two counter electrodes, an auxiliary electrode, and two reference electrodes.

229.2 And programmed, cyclic, or time responsive control means:

This subclass is indented under subclass 228.1.
Apparatus also having control means for (a) storing coded instructions or other data used to regulate operation of the apparatus, (b) repetitively regulating a sequence of operational steps performed in or by the apparatus, or (c) causing various operations to occur according to preset timing sequences or to last for predetermined durations (e.g., timer switches, etc.).

(1) Note. This subclass includes control means directly responsive to a sensed condition combined with control means which maintains an operating condition, predetermines apparatus operation, or regulates repetition.

(2) Note. This subclass is not intended to provide for apparatus merely using alternating current (AC), per se.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.03, for electrolytic object protection apparatus with control means responsive to a sensed condition and with programmed, cyclic, or time responsive control means.

196.05, for electrolytic object protection apparatus with programmed, cyclic, or time responsive control means but without control means responsive to a sensed condition.

204, 205, 211, 218, and 223, for electrolytic apparatus with movable electrode means and with means to control electrolytic current.

229.4+, for other electrolytic apparatus with programmed, cyclic, or time responsive control means but without control means responsive to a sensed condition.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclass 728 for an electrolytic process of protecting a metal or metal alloy object with control responsive to a sensed voltage and with programmed, cyclic, or time responsive control.

229.3 For controlling waveform supplied to working electrode:

This subclass is indented under subclass 229.2.
Apparatus having the programmed, cyclic, or time responsive control means adapted to control a waveform supplied to a working electrode.

(1) Note. This subclass includes apparatus adapted to control amplitude, frequency, or phase of the waveform.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 102+ for electrolytic coating processes using a specified waveform other than pure DC, subclasses 105 and 106+ for electrolytic coating processes using a specified waveform other than pure DC or 60 Hz sine wave AC, and subclasses 341+ for electrolytic synthesis processes using AC or a specified waveform other than pure DC.

229.4 With programmed, cyclic, or time responsive current, voltage, or power control means:

This subclass is indented under subclass 194.
Apparatus having control means for (a) storing coded instructions or other data used to control current, voltage, or power during operation of the apparatus, (b) repetitively regulating current, voltage, or power during operation of the apparatus, or (c) controlling current, voltage, or power according to preset timing sequences or

to last for predetermined durations (e.g., timer switches, etc.).

(1) Note. This subclass does not provide for current, voltage, or power control means directly responsive to a sensed condition but includes a current, voltage, or power control means which maintains an operating condition, predetermines apparatus operation, or regulates repetition.

(2) Note. This subclass is not intended to provide for apparatus merely using alternating current (AC), per se.

SEE OR SEARCH THIS CLASS, SUBCLASS:

196.05, for electrolytic object protection apparatus with programmed, cyclic, or time responsive control means.

204, 205, 211, 218, and 223, for electrolytic apparatus with movable electrode means and with means to control electrolytic current.

229.2+, for electrolytic apparatus with current, voltage, or power control means responsive to a sensed condition and with programmed, cyclic, or time responsive control means.

230.2+, for electrolytic apparatus with other current, voltage, or power control means.

229.5 For controlling waveform supplied to working electrode:

This subclass is indented under subclass 229.4.
Apparatus having the programmed, cyclic, or time responsive control means adapted to control a waveform supplied to a working electrode.

(1) Note. This subclass includes apparatus adapted to control waveform amplitude, frequency, or phase.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 102+ for electrolytic coating processes using a specified waveform other than pure DC, subclasses 105 and 106+ for electrolytic coating processes using a specified waveform other than pure DC or 60 Hz sine wave AC, and subclasses 341+ for electrolytic synthesis processes using AC or a specified waveform other than pure DC.

229.6 For simultaneously reversing polarity of working and counter electrodes:

This subclass is indented under subclass 229.4.
Apparatus having the programmed, cyclic, or time responsive control means adapted to simultaneously reverse polarity of working and counter electrodes.

229.7 Having specified circuit details:

This subclass is indented under subclass 229.4.
Apparatus having more than a nominal recitation of circuitry for the programmed, cyclic or time responsive control means.

229.8 With means for measuring, testing, or sensing current, voltage, or power:

This subclass is indented under subclass 194.
Apparatus having means for measuring, testing or sensing current, voltage, or power during electrolysis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

400+, for apparatus utilizing electrolytic action for analysis or testing where the testing device is claimed, per se.

556, for processes for electrical or magnetic separation or purification of liquid which involve measuring, testing, or sensing.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 81+ for electrolytic coating processes which involve measuring, analyzing, or testing; subclasses 335+ for electrolytic synthesis processes which involve measuring, analyzing, or testing; and subclass 645 for electrolytic erosion processes which involve measuring, testing or sensing.

229.9 Having auxiliary electrode:

This subclass is indented under subclass 229.8.
Apparatus having another electrode in addition

to at least one working electrode and at least one counter electrode.

230.1 Reference electrode as or with auxiliary electrode:
This subclass is indented under subclass 229.9. Apparatus having a reference electrode as or in addition to the auxiliary electrode.

(1) Note. This subclass includes an apparatus having only 3 electrodes in which the auxiliary electrode serves as a reference electrode. Also included is a combination of a working electrode, two counter electrodes, an auxiliary electrode, and two reference electrodes.

230.2 With current, voltage, or power control means:
This subclass is indented under subclass 194. Apparatus having means for controlling current, voltage, or power.

SEE OR SEARCH THIS CLASS, SUBCLASS:
204, 205, 211, 218, and 223, for electrolytic apparatus with movable electrode means and with means to control electrolytic current.

230.3 Mechanical:
This subclass is indented under subclass 230.2. Apparatus having a mechanical device for controlling current, voltage, or power.

230.4 For inhibiting short circuits:
This subclass is indented under subclass 230.2. Apparatus having current, voltage, or power control means adapted to prevent short circuits.

230.5 Switch or connector:
This subclass is indented under subclass 230.2. Apparatus having switching or connecting means for controlling current, voltage, or power.

230.6 For controlling waveform:
This subclass is indented under subclass 230.2. Apparatus having current, voltage, or power control means adapted to control a waveform applied to an electrode.

(1) Note. This subclass includes apparatus adapted to control waveform amplitude, frequency, or phase.

SEE OR SEARCH CLASS:
205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 102+ for electrolytic coating processes in which a specified waveform other than pure DC is used; subclasses 105 and 106+ for electrolytic coating processes in which a specified waveform other than pure DC or 60 Hz sine wave AC is used; and subclasses 341+ for electrolytic synthesis processes in which AC or a specified waveform other than pure DC is used.

230.7 Having auxiliary electrode:
This subclass is indented under subclass 230.2. Apparatus having at least one electrode in addition to at least one working electrode and at least one counter electrode.

230.8 Having specified circuit details:
This subclass is indented under subclass 230.2. Apparatus having more than a nominal recitation of the current, voltage, or power control means.

232 This subclass is indented under subclass 194. Apparatus including an electrolytic cell and additional means to provide for chemical or physical treatment of the electrolyte outside the cell.

233 This subclass is indented under subclass 232. Apparatus in which the additional electrolyte treatment means includes a leacher, dissolver or extractor.

234 This subclass is indented under subclass 233. Apparatus including means to recirculate the electrolyte.

(1) Note. Compare with this class, subclass 237 and indented subclasses.

(2) Note. For electrolytic cells with means for agitating the electrolyte or material therein, see this class, subclasses 261 and 273.

235 This subclass is indented under subclass 234. Apparatus in which the additional electrolyte treatment means includes a filter.

(1) Note. Compare with this class, subclasses 238 and 240.

(2) Note. For electrolytic cells having filter means, see this class, subclasses 249, 264 and 276.

236 This subclass is indented under subclass 234. Apparatus in which the additional electrolyte treatment means includes a heater or cooler.

(1) Note. Compare with this class, subclasses 239 and 241.

(2) Note. For electrolytic cells having heating or cooling means, see this class, subclasses 262 and 274.

237 This subclass is indented under subclass 232. Apparatus in which the additional electrolyte treatment means includes means to recirculate the electrolyte.

(1) Note. Search also this class, subclass 234 and indented subclasses.

(2) Note. For electrolytic cells with means for agitating the electrolyte or material therein, see this class, subclasses 261 and 273.

238 This subclass is indented under subclass 237. Apparatus in which the additional electrolyte treatment means includes a filter.

(1) Note. Search also this class, subclass 235.

(2) Note. Compare with this class, subclass 240.

(3) Note. For electrolytic cells having filter means, see this class, subclasses 249, 264 and 276.

239 This subclass is indented under subclass 237. Apparatus in which the additional electrolyte treatment means includes a heater or cooler.

(1) Note. Search also this class, subclass 236.

(2) Note. Compare with this class, subclass 241.

(3) Note. For electrolytic cells having heating or cooling means, see this class, subclasses 262 and 274.

240 This subclass is indented under subclass 232. Apparatus in which the additional electrolyte treatment means includes a filter.

(1) Note. Search also this class, subclasses 235 and 238.

(2) Note. For electrolytic cells having filter means, see this class, subclasses 249, 264 and 276.

241 This subclass is indented under subclass 232. Apparatus in which the additional electrolyte treatment means includes a heater or cooler.

(1) Note. Search also this class, subclasses 236 and 239.

(2) Note. For electrolytic cells having heating or cooling means, see this class, subclasses 262 and 274.

242 This subclass is indented under subclass 194. Electrolytic cells falling specialized to carry out any of the processes of this class.

(1) Note. For electrolytic cells for the production of or generation of electricity, see Class 429, Chemistry: Electrical Current Producing Apparatus, Product and Process.

(2) Note. For electrolytic cells not constructed for use in carrying out the processes of this class and not falling within the class definition of Class 429, Chemistry: Electrical Current Producing Apparatus, Product and Process and Class 324, Electricity: Measuring and Testing, subclasses 425+, may be found in Class 361, Electricity: Electrical Systems and Devices, wherein electrical

systems and devices are provided, see subclasses 500+.

243.1 Fused bath:
This subclass is indented under subclass 242. Apparatus having as an electrolyte a substance or mixture of material which normally exists in a solid or non-fluid physical state at normal room temperature (e.g., nonaqueous mixture, etc.) and in which the electrolyte is heated during electrolysis to an elevated temperature at which the electrolyte will change physical state to become fluid (e.g., molten salt, etc.)

(1) Note. Special materials designed for high temperature application are usually required in this type of apparatus.

SEE OR SEARCH CLASS:
205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclass 47, 211, 230+, 336, 354+, and 713 for electrolytic processes which specifically address the use of a fused bath electrolyte.

244 This subclass is indented under subclass 243. Electrolytic cells consisting of two or more distinct cell units.

(1) Note. For other plural unit cells, see this class, subclasses 253 and 267 and indented subclasses.

245 This subclass is indented under subclass 243. Electrolytic cells provided with means to feed to or withdraw material from the cell chamber.

(1) Note. For other cells with feeding and withdrawal means, see this class, subclasses 255-258, 263, 269, and 275 and indented subclasses.

246 This subclass is indented under subclass 245. Electrolytic cells provided with means to feed gaseous material to the cell chamber.

(1) Note. For other cells with gas feeding means, see this class, subclasses 256, 258, 265, 270, and 277.

247 This subclass is indented under subclass 245. Electrolytic cells provided with means to withdraw a gas from the cell chamber.

(1) Note. For other cells with gas withdrawing means see this class, subclasses 256, 258, 266, 270, and 278.

247.1 With magnetic field effect compensating means:
This subclass is indented under subclass 243.1. Apparatus having means to counteract or compensate for an undesired magnetic field.

SEE OR SEARCH THIS CLASS, SUBCLASS:
244, for a fused bath electrolytic apparatus with means to compensate for effect of a magnetic field between plural electrolytic cells.

247.2 With means for cleaning electrode element:
This subclass is indented under subclass 243.1. Apparatus having means for removing foreign material from an electrode element (e.g., anode stud, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
225+, for an electrolytic cell with electrode feeding or withdrawal means for a movable electrode.

247.3 Refractory hard material (RHM) containing electrode:
This subclass is indented under subclass 243.1. Apparatus having at least one electrode element containing a material which (a) poses significant resistance to corrosion or wear at high temperatures, (b) provides a surface which is wettable by most molten metals, and (c) conducts electrical current (e.g., electrode containing a boride, carbide, or nitride of niobium, titanium, or zirconium, etc.).

247.4 With cell lining or coating:
This subclass is indented under subclass 243.1. Apparatus having an electrolytic cell with a laminated or coated layer.

(1) Note. The lining or coating provided for in this subclass and in the indented subclass may be as simple as a metal outer

shell surrounding an electrolytic cell vessel. Also included is an electrolytic cell with thermal insulation to hinder heat transfer through a wall of the cell or with a sealing layer to preserve integrity of a wall of the cell against leakage of fused bath electrolyte.

247.5 Thermal effect compensating means:
This subclass is indented under subclass 247.4. Apparatus having a means to permit deformation of the lining with changes in cell dimensions as a result of differences in temperature (e.g., inner lining is equipped with thermal expansion joints, etc.).

248 This subclass is indented under subclass 242. Electrolytic cells in which the current supply is provided by means of an internal battery.

SEE OR SEARCH THIS CLASS, SUBCLASS:
196.04, 196.07, and 196.1+ for object promotion apparatus including electrolysis by internal battery action.

249 This subclass is indented under subclass 248. Electrolytic cells including a filter or a loose electrode material which may be in the form of a filter bed.

250 This subclass is indented under subclass 242. Electrolytic cells in which one of the electrodes of the cell is a liquid.

(1) Note. For cells with moving liquid electrodes see this class, subclass 219 and indented subclasses.

251 This subclass is indented under subclass 250. Electrolytic cells in which the electrodes are separated by a diaphragm.

(1) Note. For other diaphragm-type cells, see this class, subclass 252 and indented subclasses.

252 This subclass is indented under subclass 242. Electrolytic cells in which the electrodes are separated by a diaphragm.

(1) Note. For liquid electrode diaphragm type cells, see this class, subclass 251.

(2) Note. For electrodes with diaphragms, see this class, subclasses 282 and 283.

(3) Note. For diaphragm elements, see this class, subclasses 295 and 296.

253 This subclass is indented under subclass 252. Electrolytic cells consisting of two or more distinct units.

(1) Note. For other plural unit cells, see this class, subclasses 244 and 267 and indented subclasses.

254 This subclass is indented under subclass 253. Electrolytic cells in which at least one of the units contains an electrode of the bi-polar type, i.e., one wherein an electrode bears one polarity with respect to a second electrode and a different polarity with respect to a third electrode.

(1) Note. For other bi-polar electrode cells, see this class, subclass 268.

255 This subclass is indented under subclass 254. Electrolytic cells provided with means to feed to or withdraw material from the cell chamber.

(1) Note. For other cells with feeding or withdrawal means, see this class, subclasses 245, 257, 263, 269, and 275 and indented subclasses.

256 This subclass is indented under subclass 255. Electrolytic cells in which the material feed or withdrawn is a gas.

(1) Note. For other cells equipped with gas feeding or withdrawal means, see this class, subclasses 246, 247, 258, 265, 266, 270, 277, and 278.

257 This subclass is indented under subclass 253. Electrolytic cells provided with means to feed or withdraw material from the cell chamber.

(1) Note. For other cells with feeding or withdrawal means, see this class, subclasses 245, 255, 263, 269, and 275 and indented subclasses.

258 This subclass is indented under subclass 257. Electrolytic cells in which the material fed or withdrawn is a gas.

(1) Note. For other cells with gas feeding or withdrawal means, see this class, subclasses 246, 247, 256, 265, 266, 270, 277, and 278.

259 This subclass is indented under subclass 252. Electrolytic cells in which at least one of the electrodes is in the form of a basket, or of a porous or foraminous container surrounding the other electrode or electrodes.

260 This subclass is indented under subclass 252. Electrolytic cells in which two or more of the electrodes are arranged concentrically one within the other.

(1) Note. For other cells with concentrically arranged electrodes, see this class, subclass 272.

(2) Note. Compare with this class, subclass 259.

261 This subclass is indented under subclass 252. Electrolytic cells provided with an agitator for the electrolyte or the material being treated.

(1) Note. For other cells provided with agitating means, see this class, subclass 273.

(2) Note. See this class, subclass 221, 222 and 223, for means for agitating the electrodes.

262 This subclass is indented under subclass 252. Electrolytic cells provided with a heating or cooling means.

(1) Note. For other cells with heating or cooling means, see this class, subclass 274.

(2) Note. See this class, subclasses 236, 239 and 241 for a heater or cooler for treatment of the electrolyte outside the cell.

263 This subclass is indented under subclass 252. Electrolytic cells provided with means to feed or withdraw material from the cell chamber.

(1) Note. For other cells with feeding or withdrawal means, see this class, subclasses 245, 255, 257, 269, and 275 and indented subclasses.

264 This subclass is indented under subclass 263. Electrolytic cells including a filter as part of the cell.

(1) Note. For cells with filters, see also this class, subclasses 249 and 276.

(2) Note. See this class, subclasses 235, 238 and 240, for filters for the treatment of the electrolyte outside the cell.

265 This subclass is indented under subclass 263. Electrolytic cells provided with means to feed a gaseous material to the cell chamber.

(1) Note. For gas feeding means for cells, see also this class, subclasses 246, 256, 258, 270, and 277.

266 This subclass is indented under subclass 263. Electrolytic cells provided with means to withdraw a gas from the cell chamber.

(1) Note. For gas withdrawal means for cells, see also this class, subclasses 247, 256, 258, 270, and 278.

267 This subclass is indented under subclass 242. Electrolytic cells consisting of two or more distinct units.

(1) Note. For plural cells, see also this class, subclasses 244 and 253 and indented subclasses.

268 This subclass is indented under subclass 267. Electrolytic cells in which at least one of the units contains an electrode of the bi-polar type, i.e., one wherein an electrode bears one polarity with respect to a second electrode and a different polarity with respect to a third electrode.

(1) Note. For bi-polar electrode type diaphragm cells, see this class, subclass 254 and indented subclasses.

269 This subclass is indented under subclass 267. Electrolytic cells in which means are provided to feed to and/or withdraw material from the cell chamber.

(1) Note. For other cells with feeding or withdrawal means, see this class, subclasses 245, 255, 257, 263, and 275 and their indented subclasses.

270 This subclass is indented under subclass 269. Electrolytic cells in which material fed or withdrawn is a gas.

(1) Note. For other cells with gas feeding or withdrawal means, see this class, subclasses 246, 247, 256, 258, 265, 266, 277, and 278.

271 This subclass is indented under subclass 242. Electrolytic cells which are peculiarly designed so as to be portable.

(1) Note. Compare with this class, subclass 224.

272 This subclass is indented under subclass 242. Electrolytic cells in which two or more of the electrodes are arranged concentrically one within the other.

(1) Note. Search also this class, subclass 260.

273 This subclass is indented under subclass 242. Electrolytic cells provided with an agitator for the electrolyte or the material being treated.

(1) Note. Search also this class, subclass 261.

(2) Note. For means for agitating electrodes, see this class, subclasses 221, 222 and 223.

274 This subclass is indented under subclass 242. Electrolytic cells provided with means for heating and/or cooling.

(1) Note. For diaphragm-type cells with heating or cooling means, see this class, subclass 262.

(2) Note. See this class, subclasses 236, 239 and 241, for a heater or cooler for treatment of the electrolyte outside the cell.

(3) Note. For fused bath cells with heating means, see this class, subclass 243 and indented subclasses.

275.1 With feeding and/or withdrawal means: This subclass is indented under subclass 242. Electrolytic cells having means to feed and/or withdraw material from the cell chamber.

SEE OR SEARCH THIS CLASS, SUBCLASS:

225, and 226, for electrolytic cells with movable electrode means, and with electrode feeding or withdrawal means.

245 through 247 , 255-258, 263-266, 269, and 270 for other electrolytic cells with feeding and/or withdrawal means for other material.

FOR930,for foreign patents/non-patent literature corresponding to the subject matter of this subclass.

276 This subclass is indented under subclass 275. Electrolytic cells provided with a filter.

(1) Note. Search also this class, subclasses 249 and 264.

(2) Note. See this class, subclasses 235, 238 and 240, for filters for treatment of the electrolyte outside the cell.

277 This subclass is indented under subclass 275. Electrolytic cells provided with means to feed a gas to the cell chamber.

(1) Note. Search also this class, subclasses 246, 256, 258, 265, and 270.

278 This subclass is indented under subclass 275. Electrolytic cells provided with means to withdraw a gas from the cell chamber.

(1) Note. Search also this class, subclasses 247, 256, 258, 266, and 270.

278.5 Parallel plate type electrodes:
This subclass is indented under subclass 275.1. Electrolytic cells having at least two plate type electrodes arranged in parallel fashion.

(1) Note. This subclass is also intended to provide for bent or curved plate electrodes positioned in parallel relationship.

SEE OR SEARCH THIS CLASS, SUBCLASS:
672, and 673, for electrical separation apparatus with parallel plate type electrodes.

279 Elements specialized for carrying out any of the electrolytic processes provided for in this class which are not provided for in outside classes or below.

280 This subclass is indented under subclass 279. Apparatus consisting of electrodes useful for carrying out the processes herein provided for and combinations of such electrodes with other elements not provided for in any foregoing group of patents.

SEE OR SEARCH THIS CLASS, SUBCLASS:
400, through 435, for testing electrodes.

SEE OR SEARCH CLASS:
313, Electric Lamp and Discharge Devices, subclass 327 for self-baking electrodes such as, for example, the Soederberg electrodes, which are not limited to use in electrolysis, but can be used, for example, in arc furnaces.
428, Stock Material or Miscellaneous Articles, Lines With Other Classes and Within This Class, for the lines determining the classification of electrodes and "nominal" electrodes.
429, Chemistry: Electrical Current Producing Apparatus, Product and Process, subclasses 40+ for fuel cell catalytic electrodes, and 209+ for electrodes specialized for that class.

281 Electrodes, generally known as electroforming molds or strip plates, constructed or modified to facilitate formation of temporary coatings thereon and from which the coating or deposit is to be stripped or otherwise removed.

282 Electrodes claimed in combination with electrolytic diaphragms.

(1) Note. For diaphragms, per se, see this class, subclasses 295 and 296.

283 This subclass is indented under subclass 282. Electrode combinations in which the electrode is perforated or foraminous. Such perforated or foraminous electrodes may operate as supports or containers for the work or material being subjected to electrolytic action.

(1) Note. For other work supports or containers, see this class, subclasses 285 and 287.

SEE OR SEARCH CLASS:
428, Stock Material or Miscellaneous Articles, subclasses 596+ for apertured metallic stock material.

284 This subclass is indented under subclass 280. Electrodes which are perforated or foraminous.

(1) Note. Search this class, subclass 283 for perforated or foraminous electrodes combined with diaphragms.

SEE OR SEARCH CLASS:
428, Stock Material or Miscellaneous Articles, subclasses 596+ for apertured metallic stock material.

285 This subclass is indented under subclass 284. Electrodes constructed so as to constitute holders for the material or article being subjected to electrolytic treatment.

(1) Note. See this class, subclasses 283 and 287 for other electrodes with work supports or containers.

286.1 With electrode supporting means:
This subclass is indented under subclass 280. Electrode having electrode supporting means (e.g., electrode with hook or frame to hold the

electrode within an electrolytic cell chamber, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

198 through 226 , for movable electrode means, including supports.

227 through 278 , for electrolytic cells with electrode supporting means.

297.01 through 297.16 , for electrode supports or work holders, per se.

FOR931, for foreign patents/non-patent literature corresponding to the subject matter of this subclass and its indents.

SEE OR SEARCH CLASS:

269, Work Holders, for other supports and work holders, per se, having diverse utility, and see the class definition thereof for other related subject matter.

287 This subclass is indented under subclass 286. Electrodes in which the support is in the form of a container holding the work or material treated wherein the container does not act as an electrode.

(1) Note. See this class, subclasses 283 and 285, for other electrodes with work supports or containers.

288 This subclass is indented under subclass 286. Electrodes wherein the active portion of the electrode comprises two or more lateral extensions.

288.1 And dielectric gasket or spacer:
This subclass is indented under subclass 286.1. Apparatus also having an electrically insulating gasket or spacer (e.g., fluid seal between electrode and support, etc.).

(1) Note. The dielectric gasket or spacer may help support an electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.01 through 290.15 , for an electrode laminated or coated with a dielectric layer but without a supporting means.

288.2 And additional electrical conductor of diverse material:
This subclass is indented under subclass 286.1. Apparatus also having an additional electrical conductor of different chemical composition.

(1) Note. This subclass provides for apparatus with an auxiliary electrical conductor of different chemical composition (e.g., to enhance distribution or flow of electrolytic current during treatment, etc.). This additional conductor may also serve as a physical support means for an electrode or workpiece which conducts electrolytic current (e.g., hanging steel electrode with a copper contact arm overhanging a copper support and current carrier, etc.), or it may be a rivet or wire added to a workpiece (e.g., plural copper wires pass through a lead workpiece to provide better electrical contact with surrounding electrolyte during electrolytic coating, etc.).

288.3 Including resilient means (e.g., spring, etc.):
This subclass is indented under subclass 286.1. Apparatus including a resilient means (e.g., coil tension spring, metal spring clip, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

297.09, for an adjustable workpiece rack including a resilient means.

297.1, for a nonadjustable workpiece rack including a resilient means.

297.14, for an electrode support or work holder including a resilient means.

288.4 Including threaded connector:
This subclass is indented under subclass 286.1. Apparatus including a threaded attachment or holding means (e.g., thumb screw, nut and bolt, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

297.13, for a workpiece rack including a threaded connector.

297.15, for an electrode support or work holder including a threaded connector.

288.5 Having wedge or tapered tightening means:
This subclass is indented under subclass 288.4. Apparatus having a wedge or tapered tightening means (e.g, cone shaped insert inside a corresponding matching opening to allow tightening of a physical or electrical connection by drawing or pushing the cone into the opening to provide better contact, etc.).

(1) Note. This subclass provides for a connector with tapered threads.

288.6 Hook or loop:
This subclass is indented under subclass 286.1. Apparatus having a hook or loop (e.g., electrode having a hook or loop to allow suspension in dangling fashion from an engaged horizontal rod, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
297.16, for an electrode support or work holder having a hook or loop.

289 This subclass is indented under subclass 280. Electrodes wherein the active portion of the electrode comprises two or more lateral extensions.

(1) Note. Search also this class, subclass 288.

290.01 Laminated or coated (i.e., composite having two or more layers):
This subclass is indented under subclass 280. Electrode having a first laminated or coated layer attached to a second layer (i.e, composite having 2 or more layers).

(1) Note. The chemical components provided for in the subclasses indented under this subclass may be present in any amount and found in any or all of the layers in an overall composite electrode unless specified otherwise.

SEE OR SEARCH THIS CLASS, SUBCLASS:
281, for a coated or laminated electroforming mold or strip plate.
FOR932,and FOR 933, for foreign patents/non-patent literature corresponding to the subject matter of this subclass and its indents.

SEE OR SEARCH CLASS:
427, Coating Processes, subclasses 58 through 126.6 for processes of producing electrical products by a coating operation.
428, Stock Material or Miscellaneous Articles, subclasses 375 through 396 for a coated or structurally defined rod, strand, filament, or fiber and subclasses 411.1-704 and 615-686 for nonmetallic and metallic composites, respectively, defined in terms of the composition of their components.

290.02 Actinide series element (i.e., Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, or Lr) or compound containing:
This subclass is indented under subclass 290.01. Electrode containing an actinide series element (i.e., actinium (Ac), thorium (Th), protactinium (Pa), uranium (U), neptunium (Np), plutonium (Pu), americium (Am), curium (Cm), berkelium (Bk), californium (Cf), einsteinium (Es), fermium (Fm), mendelevium (Md), nobelium (No), or lawrencium (Lr)) or a compound thereof.

290.03 Having three or more layers:
This subclass is indented under subclass 290.01. Electrode having a total of three or more layers.

(1) Note. The chemical components provided for in the subclasses indented under this subclass may be present in any amount and found in any or all of the layers in an overall composite electrode unless specified otherwise.

290.04 Rare earth metal (i.e., Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, or Lu) or compound containing:
This subclass is indented under subclass 290.03. Electrode containing a rare earth metal (i.e., scandium (Sc), yttrium (Y), lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), or lutetium (Lu)) or a compound thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.1, for a two layer electrode containing a rare earth metal or compound thereof.

290.05 Organic compound containing:

This subclass is indented under subclass 290.03. Electrode containing an organic compound.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.11, for a two layer electrode containing an organic compound.

290.06 And noble metal (i.e., Ru, Rh, Pd, Os, Ir, Pt, Ag, or Au) or compound containing:

This subclass is indented under subclass 290.05. Electrode also containing a noble metal (i.e, ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), platinum (Pt), silver (Ag), or gold (Au)) or a compound thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.08, and 290.09, for an inorganic three or more layer electrode containing a noble metal or compound thereof.

290.14, for an inorganic two layer electrode containing a noble metal or compound thereof.

290.07 And free carbon containing:

This subclass is indented under subclass 290.05. Electrode also containing free carbon (C).

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.15, for an inorganic two layer electrode containing free carbon.

290.08 Noble metal (i.e., Ru, Rh, Pd, Os, Ir, Pt, Ag, or Au) or compound containing:

This subclass is indented under subclass 290.03. Electrode containing a noble metal (i.e, ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), platinum (Pt), silver (Ag), or gold (Au)) or a compound thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.06, for a three or more layer electrode containing both an organic compound and a noble metal or compound thereof.

290.14, for an inorganic two layer electrode containing a noble metal or compound thereof.

290.09 Plural metal oxides containing:

This subclass is indented under subclass 290.08. Electrode containing two or more metal oxide compounds (e.g., RuO_2 and TiO_2 mixed in a composite layer on Cr-doped Ti layer with Ti substrate, IrO_2 coated on Ta intermediate layer with TiO_2 substrate, etc.).

290.1 Rare earth metal (i.e., Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, or Lu) or compound containing:

This subclass is indented under subclass 290.01. Electrode containing a rare earth metal (i.e., scandium (Sc), yttrium (Y), lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), or lutetium (Lu)) or a compound thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.04, for a three or more layer electrode containing a rare earth metal or compound thereof.

290.11 Organic compound containing:

This subclass is indented under subclass 290.01. Electrode containing an organic compound.

SEE OR SEARCH THIS CLASS, SUBCLASS:

290.05, and 290.07, for a three or more layer electrode containing an organic compound.

290.12 Refractory metal (i.e., Ti, V, Cr, Zr, Nb or Cb, Mo, Hf, Ta, or W) or compound containing:
This subclass is indented under subclass 290.01. Electrode containing a refractory metal (i.e., titanium (Ti), vanadium (V), chromium (Cr), zirconium (Zr), niobium (Nb) or columbium (Cb), molybdenum (Mo), hafnium (Hf), tantalum (Ta), or tungsten (wolfram) (W)) or a compound thereof.

(1) Note. For the purposes of this subclass and the subclass indented hereunder, refractory metals will be assumed to include "valve metals" and "film-forming metals" unless specified otherwise.

290.13 Surface layer contains electrolytically exposed refractory metal or compound:
This subclass is indented under subclass 290.12. Electrode having a surface layer containing refractory metal or a compound thereof directly exposed to an electrolytic environment.

290.14 Noble metal (i.e., Ru, Rh, Pd, Os, Ir, Pt, Ag, or Au) or compound containing:
This subclass is indented under subclass 290.01. Electrode containing a noble metal (i.e., ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), iridium (Ir), platinum (Pt), silver (Ag), or gold (Au)) or a compound thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:
290.06, for a three or more layer electrode containing an organic compound and a noble metal or compound thereof.
290.08, and 290.09, for an inorganic three or more layer electrode containing a noble metal or compound thereof.

290.15 Free carbon containing:
This subclass is indented under subclass 290.01. Electrode containing free carbon (C).

SEE OR SEARCH THIS CLASS, SUBCLASS:
290.07, for a three or more layer electrode containing an organic compound and free carbon.

292 This subclass is indented under subclass 291. Electrode compositions in which a metal in the free or uncombined state comprises one of the essential ingredients of the composition.

SEE OR SEARCH CLASS:
428, Stock Material or Miscellaneous Articles, subclasses 544+ for stock materials, e.g., of indefinite length, which are all metal or have adjacent metal components.

291 This subclass is indented under subclass 280. Electrodes in which are defined merely by the composition of which they are composed.

(1) Note. In the event any specific structure is included together with a special composition, the patent is placed in the appropriate structure subclass above (or if the structure is not provided for specifically, in subclass 280, and cross-referenced here).

SEE OR SEARCH CLASS:
252, Compositions, subclasses 500+ for compositions specialized for use as electrodes and electrode devices defined solely in terms of the composition of which they are composed which electrodes are useful in electric lamps and electric space discharge devices, and as welding electrodes and furnace electrodes.

293 This subclass is indented under subclass 292. Electrodes in which an alloy comprises an essential ingredient of the composition. Steel or other metal containing alloys or carbon, silicon and other nonmetallic elements are here included as metallic alloys.

294 This subclass is indented under subclass 291. Electrodes in which carbon comprises one of the essential ingredients.

(1) Note. For carbon metal alloys, steel and the like, see this class, subclass 293.

SEE OR SEARCH CLASS:
75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Composi-

tions, and Loose Metal Particulate Mixtures, subclass 244 for a composition having a continuous phase of free metal made by consolidating metal particles and containing a carbide compound of more than one metal.

295 This subclass is indented under subclass 279. Apparatus in which the element is a diaphragm constructed for the performance of any of the electrolytic processes of this class.

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, subclass 500.21 (2) Note for the lines between this class (204) and other classes with respect to membranes defined by composition.

429, Chemistry: Electrical Current Producing Apparatus, Product and Process, subclasses 248+ for diaphragms specialized for batteries.

296 This subclass is indented under subclass 295. Electrolytic diaphragms comprising as an essential part thereof an organic member, compound or composition.

297.01 Electrode support or work holder:
This subclass is indented under subclass 279. Apparatus in which the element is an electrode support or a work holder specialized for use in an electrolytic apparatus of this class.

SEE OR SEARCH THIS CLASS, SUBCLASS:

285, and 286.1-288.6, for electrodes combined with supporting means.

FOR934-FOR936, for foreign patents/non-patent literature corresponding to the subject matter of this subclass and its indents.

SEE OR SEARCH CLASS:

269, Work Holders, for other supports and work holders, per se having diverse utility and see the class definition thereof for other related subject matter.

297.02 Magnetic support:
This subclass is indented under subclass 297.01. Apparatus having magnetic support means for an electrode or a workpiece.

297.03 Vacuum support:
This subclass is indented under subclass 297.01. Apparatus having vacuum (i.e., to create suction) support means for an electrode or a workpiece.

297.04 Float or buoyant support:
This subclass is indented under subclass 297.01. Apparatus having a float or buoyant support means for an electrode or a workpiece.

297.05 Mask for workpiece:
This subclass is indented under subclass 297.01. Apparatus having a mask to partially cover and allow selective treatment of only a portion of a workpiece.

(1) Note. This subclass is intended to provide for an apparatus having a workpiece mask regardless of whether the mask (a) constitutes part of an electrode support or work holder, or (b) is a separate feature of the apparatus not used as an electrode support or work holder.

297.06 Workpiece rack:
This subclass is indented under subclass 297.01. Apparatus having a framework, stand, or grating on or in which workpiece articles can be held for treatment (e.g., porous wire basket, overhead bar holding suspended frame and attached workpiece, etc.).

(1) Note. Although a workpiece rack is often equipped to support plural workpieces, this is not a requirement for inclusion in this and the indented subclasses.

297.07 Adjustable:
This subclass is indented under subclass 297.06. Apparatus having means specifically designed to allow adjustment of the workpiece articles or the workpiece rack (e.g., means for altering workpiece position or orientation, slide bar, lever, bolt in slot, etc.).

(1) Note. An adjustable workpiece rack allows adaptation to accommodate different workpiece dimensions or repositioning of a workpiece (e.g., for better contact with an electrolyte to ensure formation of a uniform electrolytic coating, etc.).

297.08 Mechanized:
This subclass is indented under subclass 297.07. Apparatus having machine operated means to move or adjust the workpiece articles or the workpiece rack (e.g., pneumatic piston, robotic arm, electric motor, etc.).

297.09 Including resilient means (e.g., spring, etc.):
This subclass is indented under subclass 297.07. Apparatus including a resilient means (e.g., coil tension spring, metal spring clip, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
288.3, for electrodes combined with supporting means including a resilient means.
297.1, for a nonadjustable workpiece rack including a resilient means.
297.14, for an electrode support or work holder including a resilient means.

297.1 Including resilient means (e.g., spring, etc.):
This subclass is indented under subclass 297.06. Apparatus including a resilient means (e.g., coil tension spring, metal spring clip, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
288.3, for electrodes combined with supporting means including a resilient means.
297.09, for an adjustable workpiece rack including a resilient means.
297.14, for an electrode support or work holder other than a workpiece rack including a resilient means.

297.11 Porous enclosure:
This subclass is indented under subclass 297.06. Apparatus having porous means to surround, protect, or retain a workpiece for treatment (e.g., wire basket, perforated bowl, strainer, cage, perforated support housing or canister, etc.).

(1) Note. This subclass is intended to include a porous enclosure capable of enclosing more than half of a workpiece.

(2) Note. The porous enclosure of this subclass may (a) be part of a supporting mechanism for a workpiece, or (b) it may enclose a workpiece without supporting it.

297.12 Grid or grating:
This subclass is indented under subclass 297.06. Apparatus having a foraminous plate or screen to hold a workpiece while allowing it to protrude or extend beyond the plate or screen.

(1) Note. This subclass is intended to include a porous support which allows half or more than half of a workpiece to be exposed outside the grid or grating support means during treatment.

297.13 Including threaded connector:
This subclass is indented under subclass 297.06. Apparatus including a threaded attachment or holding means (e.g., thumb screw, nut and bolt, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
288.4, and 288.5, for electrodes combined with supporting means including a threaded connector.
297.15, for an electrode support or work holder other than a workpiece rack including a threaded connector.

297.14 Including resilient means (e.g., spring, etc.):
This subclass is indented under subclass 297.01. Apparatus including a resilient means (e.g., coil tension spring, metal spring clip, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
288.3, for electrodes combined with supporting means including a resilient means.
297.09, for an adjustable workpiece rack including a resilient means.
297.1, for a nonadjustable workpiece rack including a resilient means.

297.15 Including threaded connector:
This subclass is indented under subclass 297.01. Apparatus including a threaded attachment or holding means (e.g., thumb screw, nut and bolt, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

288.4, and 288.5, for electrodes combined with supporting means including a threaded connector.

297.13, for a workpiece rack including a threaded connector.

297.16 Hook or loop:

This subclass is indented under subclass 297.01. Apparatus having a hook or loop (e.g., workpiece having a hook or loop to allow suspension in dangling fashion from an engaged horizontal rod, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

288.6, for electrodes combined with supporting means having a hook or loop.

298.01 Coating, forming or etching by sputtering:

This subclass is indented under subclass 193. Apparatus specialized for coating, forming, or etching by sputtering within a vacuum environment (i.e., under reduced pressure) involving bombarding a solid or liquid target with atomic particles to cause target material to be ejected therefrom by momentum transfer.

298.02 Coating:

This subclass is indented under subclass 298.01. Apparatus including means for the deposition of a coating material on a workpiece (i.e., substrate).

(1) Note. The coating material is usually comprised of material ejected from the target.

298.03 Measuring, analyzing or testing:

This subclass is indented under subclass 298.02. Apparatus including means for measuring, analyzing or testing at least one process parameter or product characteristic.

298.04 Ion beam sputter deposition:

This subclass is indented under subclass 298.02. Apparatus wherein a beam of ions generated by a separate ion source remote from the target is employed to sputter material from the target so that a coating of target material is deposited on a workpiece.

298.05 Ion plating:

This subclass is indented under subclass 298.02. Apparatus additionally including means for ionizing at least a portion of the evaporated coated material and for applying a potential to the workpiece, whereby the workpiece is simultaneously subjected to electrostatically aided deposition and sputter etching due to ionic bombardment.

(1) Note. In ion plating apparatus the workpiece serves as a target which is sputter etched.

(2) Note. The potential applied to the workpiece is usually negative.

298.06 Triode, tetrode, auxiliary electrode or biased workpiece:

This subclass is indented under subclass 298.02. Apparatus including electrode means (e.g., thermionic filament, screen grid, auxiliary electrode, etc.) in addition to an anode and a cathode, or including workpiece biasing means.

298.07 Specified gas feed or withdrawal:

This subclass is indented under subclass 298.02. Apparatus including significant specified means for feeding or withdrawing reactive or inert gases from the coating chamber.

(1) Note. Apparatus in which gas feed or withdrawal means are merely nominally specified are not included herein.

298.08 Specified power supply or matching network:

This subclass is indented under subclass 298.02. Apparatus including significant specified power supply means or matching network means.

(1) Note. Apparatus in which power supply means or matching network means are merely nominally specified are not included herein.

298.09 Specified cooling or heating:

This subclass is indented under subclass 298.02. Apparatus including significant specified means for cooling or heating of an electrode or work holder.

(1) Note. Apparatus in which cooling or heating means are merely nominally specified are not included herein.

298.11 Specified mask, shield or shutter:
This subclass is indented under subclass 298.02. Apparatus including significant specified means for masking, shielding or shuttering of electrodes or workpieces.

(1) Note. Apparatus in which masking, shielding or shuttering means are merely nominally specified are not included herein.

298.12 Specified target particulars:
This subclass is indented under subclass 298.02. Apparatus wherein a significant target feature or particular target construction is specified.

(1) Note. The target usually forms a part of or is associated with a cathode electrode.

298.13 Target composition:
This subclass is indented under subclass 298.12. Apparatus wherein the composition of the target is specified.

298.14 Specified anode particulars:
This subclass is indented under subclass 298.02. Apparatus wherein a significant anode feature or particular anode construction is specified.

298.15 Specified work holder:
This subclass is indented under subclass 298.02. Apparatus including significant specified means for holding a workpiece.

(1) Note. Apparatus in which work holder means are merely nominally specified are not included herein.

298.16 Magnetically enhanced:
This subclass is indented under subclass 298.02. Apparatus including significant means for magnetic enhancement of target sputtering, plasma shaping or confinement, or control of deposition parameters or deposit characteristics.

(1) Note. The means for magnetic enhancement may be either inside or outside the chamber utilized in creating the vacuum.

(2) Note. Apparatus in which magnetic means are merely nominally specified are not included herein.

298.17 Flux passes through target surface:
This subclass is indented under subclass 298.16. Apparatus including means to allow the flux to pass through a target surface.

298.18 Focusing target (e.g., conical target, plural inclined targets, etc.):
This subclass is indented under subclass 298.17. Apparatus including a magnetically enhanced sputtering target surface of conical or other particle flux focusing geometry.

298.19 Planar magnetron:
This subclass is indented under subclass 298.17. Apparatus including a magnetically enhanced generally flat planar sputtering target surface wherein lines of magnetic flux emerge from and return to the flat planar sputtering target surface.

298.2 Moving magnetic field or target:
This subclass is indented under subclass 298.19. Apparatus including means for mechanically moving or electrically shifting the magnetic enhancement means or lines of magnetic flux, or the sputtering surface, relative to each other.

298.21 Cylindrical or curved magnetron target:
This subclass is indented under subclass 298.17. Apparatus including a magnetically enhanced curved sputtering target surface which may be of cylindrical geometry.

(1) Note. Cylindrical Sputtering targets may be solid or hollow and, if hollow, sputtering may be from either the inside or outside surface.

298.22 Moving magnetic field or target:
This subclass is indented under subclass 298.21. Apparatus including means for mechanically moving or electrically shifting the magnetic enhancement means or lines of

magnetic flux, or the sputtering surface, relative to each other.

298.23 Moving workpiece or target:
This subclass is indented under subclass 298.02. Apparatus including means for moving the target or workpiece relative to each other.

298.24 Indeterminate length moving workpiece:
This subclass is indented under subclass 298.23. Apparatus including means for moving an elongated workpiece of indeterminate length.

298.25 Multi-chamber (e.g., including air lock, load/unload chamber, etc.):
This subclass is indented under subclass 298.23. Apparatus including a plurality of distinct chambers or subchambers (e.g., air lock, loading or unloading chamber, plural diverse treatment chambers, etc.) and means for moving at least one workpiece through the plurality of chambers or subchambers.

298.26 Plural diverse treatment stations, zones, or coating material source within single chamber:
This subclass is indented under subclass 298.23. Apparatus including plural diverse treatment stations or zones (e.g., plural sputter coating stations, sputter coating and etching stations, or sputter coating and other pre-treatment or post-treatment stations, etc.) within a single chamber and means for moving at least one workpiece through the plurality of stations or zones.

298.27 Plural modes of movement (e.g., planetary, epicyclic, etc.):
This subclass is indented under subclass 298.23. Apparatus including means for moving the target or workpiece in plural modes (e.g., directions), such as planetary or epicyclic motion.

298.28 Rotational movement:
This subclass is indented under subclass 298.23. Apparatus including means for rotating the target or workpiece.

298.29 Oscillatory movement:
This subclass is indented under subclass 298.23. Apparatus including means for oscillating the target or workpiece.

298.31 Etching:
This subclass is indented under subclass 298.01. Apparatus including means for the removal of material from a workpiece (i.e., substrate) by subjecting it to bombardment by atomic particles (e.g., ions), whereby the activation energy of material removal is supplied at least in part by momentum transfer.

298.32 Measuring, analyzing or testing:
This subclass is indented under subclass 298.31. Apparatus including means for measuring, analyzing or testing at least one process parameter or product characteristic (e.g., endpoint determination, etc.).

298.33 Specified gas feed or withdrawal:
This subclass is indented under subclass 298.31. Apparatus including significant specified means for feeding or withdrawing reactive or inert gases from the etching chamber.

(1) Note. Apparatus in which gas feed or withdrawal means are merely nominally specified are not included herein.

298.34 Auxiliary electrode, bias means or specified power supply:
This subclass is indented under subclass 298.31. Apparatus including electrode means in addition to an anode and cathode (e.g., auxiliary electrode, etc.), workpiece biasing means, or significant specified power supply means.

298.35 Multi-chamber, load/unload means or moving workpiece:
This subclass is indented under subclass 298.31. Apparatus including a plurality of distinct chambers or subchambers, means for loading or unloading a workpiece, or means for moving a workpiece.

298.36 Beam or directed flux etching (e.g., ion beam, etc.):
This subclass is indented under subclass 298.31. Apparatus including means for sputter etching or ion milling a workpiece utilizing a

beam of ions or directed flux generated from a separate ion source.

298.37 Magnetically enhanced:
This subclass is indented under subclass 298.31. Apparatus including means for magnetic enhancement of workpiece sputtering, plasma shaping or confinement, or control of etching parameters.

298.38 Microwave excitation:
This subclass is indented under subclass 298.31. Apparatus including means for generating plasma by excitation from a source of microwaves.

298.39 Plural parallel plates (e.g., desmearing reactor, etc.):
This subclass is indented under subclass 298.31. Apparatus including a plurality of spaced apart, parallel electrode plates or workpiece holders (e.g., desmearing reactor, etc.).

298.41 Vacuum arc discharge coating:
This subclass is indented under subclass 193. Apparatus for coating a workpiece within a vacuum environment by the action of an arc discharge between an anode and a cathode wherein the source of coating material forms or is associated with the cathode.

(1) Note. The apparatus generally includes means for generating and moving one or more cathode spots across the surface of the coating source thereby vaporizing the coating material.

400 Analysis and testing:
This subclass is indented under subclass 194. Apparatus for utilizing electrolytic action for analysis or testing where the testing device is claimed, per se.

(1) Note. Combinations of electrochemical testing devices with the systems in which they may be employed will be placed with the combination class and cross-referenced here, if necessary.

(2) Note. This and the indented subclasses include reference or testing electrodes, cells or half cells, either, per se, or in nominal combination with a broadly recited test circuit.

SEE OR SEARCH CLASS:
252, Compositions, subclass 62.2 for the composition of electrolytes for electrical condensers and recitifiers, some of which electrolytes are useful for analysis and testing.
257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), subclasses 414+ for such devices used as sensors (e.g., chemical sensors).
324, Electricity: Measuring and Testing, subclasses 323+ for the testing of underground formations by electrolytic methods as, for example, the testing of an oil well bore for water strata, and subclasses 425+ for the subject matter of this subclass in combination with significant electrical testing circuits.
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 50+ for analytical chemical apparatus including means for carrying out nonelectrochemical analysis and for apparatus for carrying out a combined chemical and electrochemical procedure.

401 Fault testing of sensor or component:
This subclass is indented under subclass 400. Apparatus including means for detecting the nonoperative condition of the electrochemical testing device or apparatus associated with it.

402 Regeneration or activation:
This subclass is indented under subclass 400. Apparatus which includes means for restoring the function of a spent or contaminated sensor part, or means for activating an electrochemical sensor for the performance of a test.

SEE OR SEARCH THIS CLASS, SUBCLASS:
403.02 through 403.05 , for an electrolytic analysis or testing apparatus for or including biological material, in which the apparatus is disposable or has a removable section but does not have means for regeneration or activation.

403.01 Biological material (e.g., microbe, enzyme, antigen, etc.) analyzed, tested, or included in apparatus:

This subclass is indented under subclass 400. Apparatus which includes a biological material or is adapted to measure electrolytically some property of a biological material (e.g., microbe, enzyme, antigen, etc.).

(1) Note. This subclass is intended to include apparatus used in an electrolytic measurement of a micro-organism, enzyme, antigen, or antibody.

SEE OR SEARCH CLASS:

128, Surgery, for apparatus used in the inspection and treatment of diseases of the bodies of humans and animals and is provided with means for connection with the living body.

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, especially subclass 777.5 and 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism and subclasses 779 and 792 for other electrolytic analysis or testing processes of biological fluid or material.

257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), especially subclass 253 for field effect transistors responsive to a nonoptical, nonelectrical signal (e.g., ISFET, CHEMFET, etc.); and subclasses 414-470 for other active solid-state devices responsive to a nonelectrical signal (e.g., chemical, stress, light, or magnetic field sensors, etc.).

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 50 through 104, especially subclasses 82.01-82.04 for analytical chemical apparatus including means for carrying out nonelectrochemical analysis and for apparatus for carrying out a combined chemical and eletrochemical procedure.

435, Chemistry: Molecular Biology and Microbiology, for an apparatus for separately measuring or testing an electrical or wave energy property, which property exists in combination with a system wherein (a) a micro-organism is cultured or present or (b) an enzyme functions catalytically (e.g., a fermentor in combination with a pH electrode, etc.).

600, Surgery, especially subclasses 345 through 361, for electronanlysis apparatus used in the diagnostic testing of the bodies of humans and animals and is provided with means for connection with the living body.

403.02 Disposable apparatus or apparatus having removable section (e.g., removable cartridge, etc.):

This subclass is indented under subclass 403.01. Apparatus which is intended to be discarded after use or is provided with a part or section designed to be detached and/or replaced with another part or section (e.g., removable cartridge, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

402, for an electrolytic testing apparatus having means for regeneration or activation.

403.03 Plural measuring sections or zones:

This subclass is indented under subclass 403.02. Apparatus having two or more distinguishable parts or regions for conducting electrolytic testing or analysis.

(1) Note. The apparatus in this subclass is usually designed and intended to detect two or more different analytes.

403.04 Enzyme included in apparatus:

This subclass is indented under subclass 403.02. Apparatus which includes an enzyme.

(1) Note. The enzyme is usually used to stimulate an interaction with a target analyte and yield a sensed compound or element.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403.09, for a similar electrolytic testing apparatus having an enzyme and a semi-permeable membrane for blocking

passage of macromolecules but without being disposable or having a removable section.

403.1 through 403.12 , for a similar electrolytic testing apparatus having an enzyme and a semipermeable membrane but not for blocking passage of macromolecules and without being disposable or having a removable section.

403.14, for a similar electrolytic testing apparatus having an enzyme but without being disposable or having a removable section and without a semipermeable membrane.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 777.5 and 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism.

600, Surgery, subclass 777.5 and 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism.

403.05 With semipermeable membrane:

This subclass is indented under subclass 403.04. Apparatus having a membrane to separate some particles, molecules, or species from others by allowing only some of the particles, molecules, or species to pass through while others are retained at or stopped from passing through the membrane.

(1) Note. This subclass is not intended to provide for the mere use of a perforated electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403.06 through 403.13 , for a similar electrolytic testing apparatus having a semipermeable membrane but without being disposable or having a removable section.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism and using a semipermeable membrane.

403.06 With semipermeable membrane:

This subclass is indented under subclass 403.01. Apparatus having a membrane to separate some particles, molecules, or species from others by allowing only some of the particles, molecules, or species to pass through while others are retained at or stopped from passing through the membrane.

(1) Note. This subclass and the subclasses indented hereunder are not intended to provide for the mere use of a perforated electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403.05, for a similar electrolytic testing apparatus which is disposable or has a removable section and has an enzyme and a semipermeable membrane.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism and using a semipermeable membrane.

403.07 For blocking passage of macromolecules (molecular weight greater than or equal to 8,000):

This subclass is indented under subclass 403.06. Apparatus in which the membrane is used to prevent passage of large molecules with a molecular weight greater than or equal to 8,000 (e.g., proteins, etc.).

403.08 Lipid included in apparatus:

This subclass is indented under subclass 403.07. Apparatus which includes a lipid.

(1) Note. One or more lipids are usually supported by the membrane (e.g., lipid bilayer membrane, etc.).

SEE OR SEARCH CLASS:

436, Chemistry: Analytical and Immunological Testing, subclass 71 for a non-electrolytic chemical test for lipids, triglycerides, cholesterol, or lipoproteins and compositions used in the test.

403.09 Enzyme included in apparatus:

This subclass is indented under subclass 403.07. Apparatus which includes an enzyme.

(1) Note. The enzyme is usually used to stimulate an interaction with a target analyte and yield a sensed compound or element.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403.05, for a similar electrolytic testing apparatus which is disposable or has a removable section and has an enzyme and a semipermeable membrane.

403.1 through 403.12 , for a similar electrolytic testing apparatus having an enzyme and a semipermeable membrane but not for blocking the passage of macromolecules and without being disposable or having a removable section.

403.14, for a similar electrolytic testing apparatus having an enzyme but without a semipermeable membrane and without being disposable or having a removable section.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism and using a semipermeable membrane.

403.1 Enzyme included in apparatus:

This subclass is indented under subclass 403.06. Apparatus which includes an enzyme.

(1) Note. The enzyme is usually used to stimulate an interaction with a target analyte and yield a sensed compound or element.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403.05, for a similar electrolytic testing apparatus which is disposable or has a removable section and has an enzyme and a semipermeable membrane.

403.09, for a similar electrolytic testing apparatus having a semipermeable membrane for blocking the passage of macromolecules and having an enzyme, but without being disposable or having a removable section.

403.14, for a similar electrolytic testing apparatus having an enzyme but without being disposable or having a removable section and without having a semipermeable membrane.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism and using a semipermeable membrane.

403.11 Glucose oxidase:

This subclass is indented under subclass 403.1. Apparatus in which the enzyme is glucose oxidase.

(1) Note. This subclass includes an electrolytic testing apparatus which uses glucose oxidase to catalyze the oxidation of glucose to gluconic acid.

403.12 With diverse enzyme or catalyst (e.g., bienzyme or coenzyme system, glucose oxidase with Pt catalyst, etc.):

This subclass is indented under subclass 403.11. Apparatus which includes (a) another different enzyme (in addition to glucose oxidase) or (b) a nonenzymatic catalyst (in addition to the enzyme glucose oxidase) (e.g., bienzyme or coenzyme system, glucose oxidase with Pt catalyst, etc.).

403.13 And microelectrode (i.e., at least one electrode dimension is less than 500 microns):
This subclass is indented under subclass 403.06. Apparatus having an electrode with at least one dimension (e.g., thickness, diameter, etc.) which is less than 500 microns (i.e., 0.5 mm).

(1) Note. This small dimension is usually to allow placement of a sensing means in a confined space.

403.14 Enzyme included in apparatus:
This subclass is indented under subclass 403.01. Apparatus which includes an enzyme.

(1) Note. The enzyme is usually used to stimulate an interaction with a target analyte and yield a sensed compound or element.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403.04, and 403.05, for a similar electrolytic testing apparatus which is disposable or has a removable section and an enzyme.

403.09, for a similar electrolytic testing apparatus having an enzyme and a semipermeable membrane for blocking the passage of macromolecules but without being disposable or having a removable section.

403.1 through 403.12 , for a similar electrolytic testing apparatus having an enzyme and a semipermeable membrane but not for blocking the passage of macromolecules and without being disposable or having a removable section.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 777.5 and 778 for electrolytic analysis or testing processes involving an enzyme or a micro-organism.

403.15 Electrode containing free carbon:
This subclass is indented under subclass 403.01. Apparatus having an electrode containing free carbon (e.g., graphite, etc.).

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, for electrolytic analysis or testing processes; especially subclass 780 for detection of halogen or a halogen containing compound using an electrode containing precious metal or free carbon, subclass 786 for detection of oxygen or an oxygen containing compound using an electrode containing precious metal or free carbon, and subclass 794.5 for other electrolytic tests using an electrode containing precious metal or free carbon.

404 Corrosion:
This subclass is indented under subclass 400. Apparatus for electrolytically testing the corrosion resistance of materials or the effect of corrosive or corrosion inhibiting materials.

SEE OR SEARCH CLASS:

73, Measuring and Testing, particularly subclass 61.2 and 104 for methods of physical determination of corrosive properties.

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 53 for apparatus for chemically investigating corrosion resistance or power.

436, Chemistry: Analytical and Immunological Testing, subclass 6 for processes of chemically testing corrosion resistance or power.

405 Titration:
This subclass is indented under subclass 400. Apparatus which is designed for or combined with means for conducting an electrolytic titration.

SEE OR SEARCH CLASS:

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 50 for integrated analyzers which may include nominal electrode structure in a titration device.

406 With significant electrical circuitry or nominal computer device:

This subclass is indented under subclass 400. Apparatus in which the measuring electrode is operable connected to a claimed arrangement of electrical elements or is claimed as connected to a computer.

(1) Note. This subclass is intended to provide for documents which claim an electrochemical sensor in combination with a circuit other than a mere recital of a current or potential measuring means, i.e., claim language like "analysis means for measuring an electrical potential developed" is not provided for here.

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 266 through 274 for chemical process control or monitoring systems in combination with a data processing system or calculating computer

407 With significant display or analytical device:

This subclass is indented under subclass 400. Apparatus in which the electrical signal produced by the measuring electrode is claimed as driving a device which produces a visible or audible signal or an analytical device.

(1) Note. This subclass is intended to provide for display devices of claimed structure, i.e., with indicating scales, particular arrangements of display lights, etc., and is not intended to provide for a nominal display means.

SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, appropriate subclasses for apparatus for testing an electrical property or condition even though the results of the test may be used to indicate some other physical or chemical property or condition.

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclass 50 for analyzers or structured indicators for quantitative or qualitative chemical analysis.

408 With means for temperature or pressure compensation:

This subclass is indented under subclass 400. Apparatus including means for compensating for the physical or electrical effects of temperature or pressure on the apparatus.

(1) Note. The compensation may be a separate measurement of temperature or pressure which is used to produce a signal representing the effect of temperature or pressure or may be in the physical design of the measuring electrode or associated apparatus.

409 With means providing specified flow-condition or flow-path:

This subclass is indented under subclass 400. Apparatus which is designed to provide a particular flow-path through or around an electrode surface or to promote a particular type of flow over the electrode surface.

(1) Note. This and the indented subclass are intended to provide for apparatus in which the fluid to be analyzed flows in a labyrinthine manner, or a series of treatment stations or apparatus claimed or disclosed as providing a particular flow state at the electrode surface, e.g., laminar flow, turbulent flow, etc.

410 Solid electrolyte means:

This subclass is indented under subclass 409. Apparatus which incorporates a solid electrolyte.

SEE OR SEARCH THIS CLASS, SUBCLASS:

421+, for apparatus incorporating one or two electrodes with a solid electrolyte.

411 Three or more electrodes:

This subclass is indented under subclass 409. Apparatus which contains an arrangement of three or more electrodes.

412 Three or more electrodes:

This subclass is indented under subclass 400. Apparatus in which there are three or more electrodes.

(1) Note. This subclass is intended to provide for arrangements of several physically identical electrolytic cells.

413 Liquid electrodes, e.g., Hg, Na, etc.:
This subclass is indented under subclass 400. Apparatus in which at least one electrode is a liquid.

(1) Note. The electrodes included herein are typically liquid metals particularly sodium or mercury.

414 Gel electrolyte:
This subclass is indented under subclass 400. Apparatus in which the electrolyte is a gel.

(1) Note. A gel is a colloidal solution of a liquid in a solid. Typically the gels herein are hydrogels, i.e., a solid colloidal solution in water.

SEE OR SEARCH CLASS:
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 98+ for colloid systems of continuous or semicontinuous solid phase with discontinuous liquid phase (gels, pastes, flocs, coagulates) or agents for such systems or making or stabilizing such systems or agendts, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

415 Selectively permeable membrane:
This subclass is indented under subclass 400. Apparatus in which a constituent of the fluid being treated diffuses through a material which acts as a barrier to other constituents of the fluid permitting only the selected constituent to contract the electrode surface.

SEE OR SEARCH THIS CLASS, SUBCLASS:
416+, for electrodes which are themselves selective as to ionic species.

SEE OR SEARCH CLASS:
210, Liquid Purification or Separation, subclass 644 for processes of use of selectively permeable membranes.

416 Ion-sensitive electrode:
This subclass is indented under subclass 400. Apparatus which incorporates means which permit only desired ionic species to participate in the electrochemical reaction in a sensing electrode.

(1) Note. Ion-sensitive membranes include: (a) compressed bodies of inorganic salts; (b) monocrystals of such salts; (c) fine powders of such salts embedded in a resin or glass; (d) porous bodies with an adsorbed solution of an ion-exchanger solution.

417 Liquid ion-exchanger:
This subclass is indented under subclass 416. Apparatus in which the ion-exchange medium is a liquid.

418 Organic membrane:
This subclass is indented under subclass 416. Apparatus in which the ion-selective membrane is organic.

(1) Note. Organic compounds are compounds containing carbon which are further characterized by the presence of two carbon atoms bonded together or one atom of carbon bonded to at least one atom of hydrogen or halogen or one atom of carbon bonded to one atom of nitrogen by a single or double bond.

(2) Note. Typically the patents herein include a resin matrix plus an ion exchange material, e.g., an organic metal salt, metal salt or metal ion, etc.

419 Inorganic membrane:
This subclass is indented under subclass 416. Apparatus in which the ion-selective membrane is inorganic.

420 Glass ion-selective membrane:
This subclass is indented under subclass 419. Apparatus in which the inorganic ion-selective membrane is glass.

421 Solid electrolyte:
This subclass is indented under subclass 400. Apparatus which incorporates a solid electrolyte.

422 Liquid sample sensor:
This subclass is indented under subclass 421. Apparatus which is adapted to be used for the analysis or testing of a liquid sample.

(1) Note. Liquid includes molten metals.

423 With fugitive protective element:
This subclass is indented under subclass 422. Apparatus in which part of the sensor is designed to protect the remainder from environmental damage and having served this function is designed to decompose leaving the sensor element in contact with the liquid sample.

(1) Note. The subject matter of this subclass includes a cap or plug of resinous or resin containing material which is melted by the liquid sample.

424 Gas sample sensor:
This subclass is indented under subclass 421. Apparatus in which the primary component of the sample is gaseous.

(1) Note. This subclass includes solid electrolyte gas sensors in which the partial pressure of the reference gas is provided by a solid.

SEE OR SEARCH THIS CLASS, SUBCLASS:
422, for apparatus sensing dissolved gas in a liquid sample.

425 With impressed current means:
This subclass is indented under subclass 424. Apparatus in which a current is impressed on the sensor by means other than interaction with the sample or reference material.

(1) Note. The impressed current can be for the electrolytic generation of a reference gas.

426 Planar electrode surface:
This subclass is indented under subclass 424. Apparatus in which the sensing element is generally flat.

(1) Note. This subclass includes electrodes in which the sensing element is a flat disk.

427 With gas reference material:
This subclass is indented under subclass 424. Apparatus having a solid electrolyte with electrode films attached to the sides which are in turn in contact with a gas sample and a reference gas.

(1) Note. Oxygen sensor for control of air/fuel ratio in internal combustion engines are included herein.

(2) Note. The reference gas is usually provided by an opening to admit atmospheric air.

SEE OR SEARCH THIS CLASS, SUBCLASS:
424, for gas sensors in which the reference material is a solid material which produces the particle pressure as a reference standard.

428 With protective element:
This subclass is indented under subclass 427. Apparatus in which part of the sensor assembly to shield the remainder from the deleterious chemical or physical effects of the sample or atmospheric gas.

(1) Note. The protective element is typically a screen or perforate or slotted solid member but may also be an ablative material.

(2) Note. This subclass includes protective elements for the sensor, e.g., caps for the sensor end, as well as protective elements at the reference end, e.g., filters in the reference gas entryway, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
425, for fugitive protective elements for solid electrolyte containing sensors.

429 Protective element is a layer:
This subclass is indented under subclass 428. Apparatus in which the protective element is an adherent layer on the surface of the sensor assembly.

(1) Note. This subclass would include a layer of material impregnated with a getter for catalyst poisons.

430 Moisture absorbing electrolyte:
This subclass is indented under subclass 400. Apparatus in which the electrolyte of the sensor absorbs water.

SEE OR SEARCH CLASS:
73, Measuring and Testing, subclass 75 for moisture determination by electrical or thermal conductivity.
236, Automatic Temperature and Humidity Regulation, subclass 44 for control of the humidity of an area and subclass 44 for use of an electrically conductive element.
338, Electrical Resistors, subclasses 34+, for moisture absorbing resistors.

431 Gas sensing electrode:
This subclass is indented under subclass 400. Apparatus which detects the presence quantity or identity of a gas.

(1) Note. This subclass provides for trace gas detectors, detecting for example, oxygen, sulfur dioxide, carbon monoxide or hydrogen sulfide by means of a liquid electrolyte since solid electrolytes are provided for above.

SEE OR SEARCH THIS CLASS, SUBCLASS:
421+, particularly 424 for a solid electrolyte electrode for gas analysis.

432 With gas diffusion electrode:
This subclass is indented under subclass 431. Apparatus in which a gas diffuses through part of an electrode.

433 Measuring carbon content or pH:
This subclass is indented under subclass 400. Apparatus for the measurement of the quality of carbon in a fluid or for the measurement of the hydrogen ion content of a fluid.

(1) Note. This subclass provides for apparatus for monitoring the carbon content of liquid sodium reactor coolant.

SEE OR SEARCH THIS CLASS, SUBCLASS:
423, for apparatus utilizing a solid electrolyte and a fugitive protective element of analysis of liquid metal compositions.

434 Involving plating, coating or stripping:
This subclass is indented under subclass 400. Apparatus including means for electrolytically applying or removing a layer of material in the performance of a test or analysis.

(1) Note. This subclass provides for anodic stripping voltametric apparatus in which a minute amount of material is tested for by electrochemically depositing and subsequently stripping a material on an electrode.

(2) Note. Further examples of the subject matter included herein is apparatus for trace metal detection, coating thickness determination, analytical electroplating and test plating.

435 Standard reference electrode:
This subclass is indented under subclass 400. Apparatus including means for producing a precise and reproducible reference potential.

(1) Note. As no attempt has been made to cross-reference all apparatus in which a reference cell is present, if such a cell is claimed in combination with features provided for in a preceding subclass a search of that subclass is generally indicated.

450 Electrophoresis or electro-osmosis processes and electrolyte compositions therefor when not provided for elsewhere:

This subclass is indented under the class definition. Subject matter drawn to (a) processes involving (1) the travel, transport, or relative movement of one or more particles or components in a conducting liquid or fluent material, other than a gas, under a net unidirectional electric stress or (2) the movement of a liquid inside the capillary spaces of a solid (e.g., membrane, etc.) under the influence of an electric field or (b) electrolyte compositions specialized for use in a process under (a) when not provided for elsewhere.

(1) Note. For the purpose of Class 204, "electrophoresis" is restricted to situations where the liquid or fluent material is electrically conductive and wherein there is at least one electrolytic phenomenon (e.g., electrode gas formation, etc.) inherently or otherwise taking place simultaneously with electromigration of the particles or components.

(2) Note. In electrophoresis, the moved particles or components usually are electrically charged.

SEE OR SEARCH THIS CLASS, SUBCLASS:

554+, for electrical separation or purification of liquid not involving electrolysis, electrophoresis, or electro-osmosis.

600+, for corresponding electrophoretic or electro-osmotic apparatus.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, appropriate subclasses for electrolytic processes.

340, Communications: Electrical, for various types of electrical communications systems and methods not provided for in other classes.

356, Optics: Measuring and Testing, subclass 344 for processes of testing the change in refractive index of a fluid in an electrophoresis cell and the apparatus therefor and subclasses 128+ for refraction testing processes and apparatus therefor.

358, Facsimile and Static Presentation Processing, for data processing for presentation to printer, and facsimile system.

359, Optics: Systems (Including Communication) and Elements, for optical elements and systems not provided for in other classes.

399, Electrophotography, for electronphotographic processes and apparatus.

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

451 Capillary electrophoresis:

This subclass is indented under subclass 450. Process involving electromigration of particles or components in a conducting liquid or fluent material inside a tube with an inside diameter less than 1 mm.

(1) Note. For classification in this subclass and the subclasses indented hereunder, use of a "capillary" or very small tube of undisclosed inside diameter is presumed to be small enough.

452 With detailed detection:

This subclass is indented under subclass 451. Process which includes the use of a detection system recited in more detail than mere nominal mention.

(1) Note. This subclass is not intended to provide for the mere use of plotters or other recording devices unless combined with at least one detailed detector element or device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

461, for gel electrophoresis with analysis or detailed detection, but without using a capillary.

453 With injection:

This subclass is indented under subclass 451. Process in which material to be treated or tested is injected into the capillary, usually by electro-osmotic bulk flow.

SEE OR SEARCH THIS CLASS, SUBCLASS:

454, for capillary electrophoresis with adjustment or alteration of electro-osmotic bulk flow.

454 With adjustment or alteration of electro-osmotic bulk flow:

This subclass is indented under subclass 451. Process which provides for adjustment or alteration of continuous phase buffer liquid movement within the capillary.

(1) Note. Reduction or reversal of electro-osmotic bulk flow with respect to the direction of electrophoretic movement of suspended particles or components is used to enhance separation therebetween.

SEE OR SEARCH THIS CLASS, SUBCLASS:

453, for capillary electrophoresis with injection by electro-osmotic bulk flow of material to be treated or tested.

455 Using gel-filled capillary:

This subclass is indented under subclass 451. Process in which the inside of the capillary tube is filled with a jellylike colloidal solution of liquid in a solid (usually organic).

(1) Note. This subclass is not intended to provide for the use of a capillary filled with an inorganic solid (e.g., silica gel, etc.) which is not present as a jellylike colloidal solution of a liquid in the inorganic solid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

456+, for gel electrophoresis without using a capillary.

456 Gel electrophoresis:

This subclass is indented under subclass 450. Process in which particles or components migrate in an electric field within a continuous medium of a jellylike colloidal solution of liquid in a solid (usually organic).

(1) Note. This subclass and the subclasses indented hereunder are not intended to provide for the use of a continuous medium of an inorganic solid (e.g., silica gel, etc.) which is not present as a jellylike colloidal solution of a liquid in the inorganic solid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

455, for organic gel electrophoresis using a capillary filled with an organic gel.

457 With programmed, cyclic, or time responsive control:

This subclass is indented under subclass 456. Process which involves (a) storing coded instructions or other data which are used to regulate the process, (b) repetitively regulating a sequence of process steps, or (c) regulating the process according to preset timing sequences (e.g., limiting various process steps to predetermined durations of time, etc.).

(1) Note. This subclass and the subclass indented hereunder includes any control which maintains an operating condition, predetermines apparatus operation, or regulates repetition.

(2) Note. This subclass and the subclass indented hereunder is not intended to provide for the mere use of alternating current (AC), per se.

458 Plural rapid changes in direction of electric field (at least 1000 times total and at more than 1/sec) (e.g., pulsed field, etc.):

This subclass is indented under subclass 457. Process in which the electric field changes direction more than 1000 times in rapid succes-

sion (more than one change per second), usually using more than 2 electrodes with synchronized timing of voltage spikes or peaks.

459 Isoelectric focusing (i.e., using pH variation):
This subclass is indented under subclass 456. Process in which a differential pH gradient is established in the medium to affect the migration of individual particles or components based on their different isoelectric points (the different pH values at which the net charge on each particle or component is neutral).

SEE OR SEARCH THIS CLASS, SUBCLASS:
548, for isoelectric focusing without using a gel.

461 With analysis or detailed detection:
This subclass is indented under subclass 456. Process which includes analysis or the use of a detection system recited in more detail than mere nominal mention.

(1) Note. This subclass is not intended to provide for the mere use of plotters or other recording devices unless combined with at least one detailed detector element or device or when clearly used in a process of analysis.

SEE OR SEARCH THIS CLASS, SUBCLASS:
452, for capillary electrophoresis with detailed detection.

462 With posttreatment of gel to purify or recover a desired component:
This subclass is indented under subclass 456. Process in which the gel is subsequently treated to purify or recover a desired component.

463 Destaining:
This subclass is indented under subclass 462. Process in which the posttreatment involves removal of a colored component, usually present as an undesired impurity which masks the desired separation of components.

464 Blotting:
This subclass is indented under subclass 462. Process in which one or more desired separated components are transferred from the gel to an adjacent receiving medium (e.g., membrane, sorbent, another gel, etc.).

(1) Note. The transfer may be assisted by an external force (e.g., hydraulic pressure, electric field, etc.).

465 Preparation in unitary apparatus (e.g., preparative, etc.):
This subclass is indented under subclass 456. Process which is conducted to yield a separated product in final form (e.g., ready for analysis, etc.) using a single piece of apparatus, usually precluding the need for subsequent treatment or transfer of separated species.

(1) Note. The preparative nature of gel electrophoresis or an apparatus used therein must be specifically recited for placement in this subclass.

466 Using slab gel:
This subclass is indented under subclass 456. Process in which the gel is planar in form (e.g., as a rectangular sheet, etc.).

467 Vertical or inclined:
This subclass is indented under subclass 466. Process in which the slab is in an upright position or is tipped up during use (e.g., vertical slab, etc.).

468 Electrolyte composition:
This subclass is indented under subclass 456. Subject matter drawn to (a) electrolyte compositions or (b) processes of gel electrophoresis using an electrolyte of specified composition.

(1) Note. This subclass is not intended to provide for the use of merely an “aqueous” buffer solution electrolyte unless further detail of the electrolyte composition is recited.

469 Gel composition (other than simple agarose or polyacrylamide):
This subclass is indented under subclass 456. Subject matter drawn to (a) gel compositions (other than simple agarose or polyacrylamide)

or (b) processes of gel electrophoresis using a gel of specified composition (other than simple agarose or polyacrylamide).

(1) Note. The gel may contain a combination of agarose or polyacrylamide with another specified component but must not be comprised of only agarose or polyacrylamide as the only specified components.

470 Including manufacture or preparation (e.g., molding, gelation, etc.):

This subclass is indented under subclass 469. Subject matter which includes one or more steps of gel manufacture or preparation (e.g., molding, gelation, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

521, for electrophoretic or electro-osmostic ion selective barrier separation combined with manufacture or pretreatment of the barrier.

471 Coating or forming of object:

This subclass is indented under subclass 450. Process directed to the coating of a substrate or the formation of an object by electrophoresis or electro-osmosis.

(1) Note. Electrophoretic forming processes are defined herein as an electrophoretic coating process wherein the coated layer is subsequently removed from the coated substrate.

SEE OR SEARCH THIS CLASS, SUBCLASS:

192.1+, for processes of coating or forming by sputtering.

622+, for corresponding apparatus.

SEE OR SEARCH CLASS:

8, Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers, especially subclass 444 for a nonelectrolytic process of bleaching, dyeing, or fluid treatment of textiles or fibers utilizing electric, magnetic, or wave energy; or a product thereof.

106, Compositions: Coating or Plastic, appropriate subclasses for certain bath compositions used in electrophoretic coating procedures and the notes thereto for the line between Class 106 and other classes providing for coating compositions.

205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 67+ for electroforming and subclasses 80+ for electrolytic coating.

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, especially subclasses 22+ for processes of shaping and treating provided for in this class (264) without involving electrical or wave energy to effect a chemical reaction, per se, and without involving electrophoresis.

427, Coating Processes, subclasses 457+ for coating processes utilizing electrical energy to deposit particles out of a liquid by other than electrolysis, electrophoresis, or electro-osmosis.

428, Stock Material or Miscellaneous Articles, for coated products in general, especially subclass 547 for a metallic stock material having metal particles and a composition or density gradient or differential porosity.

430, Radiation Imagery Chemistry: Process, Composition, or Product, subclasses 32+ for a process of applying a coating of particles from an insulating suspending liquid by applying an electric field in combination with imagewise exposure to radiation, including compositions used in and products produced by such a process; and subclass 52 for “electrolysis imaging” or “photoconductography.”

472 With control responsive to sensed condition:

This subclass is indented under subclass 471. Process in which the coating or forming is regulated by detecting a characteristic or a change in a characteristic of the process and by implementing an action in the process based upon the detected characteristic or change therein.

(1) Note. In this subclass and the subclasses indented hereunder a single means may

be used both to detect a characteristic or a change in a characteristic of the process and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

480+, for electrophoretic coating or forming of an object involving regeneration or replenishment of the coating bath but without control directly responsive to a sensed condition.

519, for electrophoretic or electro-osmotic barrier separation with control responsive to sensed condition.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though non-electrical values may be derived from the electrical properties determined.

473 Temperature sensed:

This subclass is indented under subclass 472. Process in which a detected temperature or a change in a detected temperature is used to control the process.

474 Current sensed:

This subclass is indented under subclass 472. Process in which a detected current or a change in a detected current is used to control the process.

475 Rubber or vulcanizable gum used to coat or form:

This subclass is indented under subclass 471. Process directed to the coating or formation of objects with (a) a natural or synthetic elastic polymer commonly known as rubber (e.g., caoutchouc, neoprene, etc.) or (b) a gum which may be vulcanized (cross-linked) (e.g., by reaction with sulphur at an elevated temperature, etc.) from a tacky, plastic mixture to an elastic or rigid product.

476 Sheet, web, wire, or filament of indeterminate length formed or coated:

This subclass is indented under subclass 475. Process directed to the coating or formation of sheets, webs, wire, or filaments of indeterminate length.

SEE OR SEARCH CLASS:

428, Stock Material or Miscellaneous Articles, appropriate subclasses for a stock material product in the form of a composite or plural component web or sheet which is not provided for elsewhere. See also Lines With Other Classes, in Class 428.

477 Alternating current:

This subclass is indented under subclass 471. Process in which alternating electrical current is used.

478 With irradiation or illumination (e.g., for curing, etc.):

This subclass is indented under subclass 471. Process in which electromagnetic waves (e.g., ultraviolet light, gamma rays, etc.) or corpuscular radiation (e.g., stream of alpha particles, electron beam, etc.) is applied to the substrate or to a coated layer (e.g., for curing, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

487+, 491, 493+, 500+, 507, and 509, for electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

479 Coating interior of object:

This subclass is indented under subclass 471. Process in which a coating is formed on the interior of an object.

480 With regeneration or replenishment of coating bath (e.g., ultrafiltration, ion exchange, measurement followed by addition of concentrated reagent, etc.):

This subclass is indented under subclass 471. Process which includes purification or rejuvenation (e.g., using ultrafiltration, ion exchange,

etc.) or concentration adjustment of the coating bath (e.g., measurement followed by addition of concentrated reagent, etc.).

(1) Note. The type of measurement followed by replenishment for concentration adjustment which is provided for in this subclass and the subclasses indented hereunder does not include any adjustment which is controlled in direct response to a sensed condition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

472+, for electrophoretic coating or forming of an object with control that is responsive to a sensed condition.

481 Using ion exchange material:

This subclass is indented under subclass 480. Process in which ion exchange material is used to regenerate or replenish the coating bath.

SEE OR SEARCH THIS CLASS, SUBCLASS:

524, and 536, for electrophoretic or electro-osmotic ion selective barrier separation in which an ion exchange material is also employed.

482 Using filter or membrane:

This subclass is indented under subclass 480. Process in which a filter or membrane is used to regenerate the coating bath.

483 Forming of object:

This subclass is indented under subclass 471. Process directed to the formation of an object.

(1) Note. Electrophoretic forming processes are defined herein as electrophoretic coating processes wherein the coated layer is subsequently removed from the substrate, thus forming an object.

SEE OR SEARCH CLASS:

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, especially subclasses 22+ for processes of shaping and treating provided for in this class (264) without involving electrical or wave energy to effect a chemical reaction, per se, and without involving electrophoresis.

484 Plural coating operations:

This subclass is indented under subclass 471. Process directed to the coating of a substrate with at least two layers and wherein at least one of the layers is applied electrophoretically or electro-osmotically.

(1) Note. A single step coating process wherein a previously coated object that is being coated (e.g., single step coating of an electrostatically sprayed object, etc.) is not considered to encompass plural coating operations for this subclass or the subclasses indented hereunder.

485 Using mask:

This subclass is indented under subclass 484. Process in which a mask is used to shield selected areas of the substrate during coating.

486 Including nonelectrophoretic coating:

This subclass is indented under subclass 484. Process which employs at least one nonelectrophoretic coating step (e.g., impregnation, electrostatic spraying, etc.).

487 With heat treatment of a coated layer (e.g., curing, sintering, etc.):

This subclass is indented under subclass 486. Process in which at least one of the coated layers is heated to effect a desired change therein (e.g., curing, sintering, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

478, for an electrophoretic or electro-osmotic coating or forming process with use of radiation energy.

491, 493+, 500+, 507, and 509, for other electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

488 Organic (e.g., curing thermoset resin, etc.):

This subclass is indented under subclass 487. Process in which the heat treated layer contains organic material.

489 Using bath having designated chemical composition (DCC):
This subclass is indented under subclass 471. Process which specifically identifies a coating bath used in the coating process as containing a designated chemical composition (DCC).

(1) Note. A designated chemical composition is a composition wherein at least one chemical atom is identified. For a more comprehensive definition of designated chemical composition (including exceptions and examples), see DEFINITION OF TERMS under the main definition of this class.

490 Resultant coating is solely inorganic:
This subclass is indented under subclass 489. Process in which the resultant coating contains no organic material.

(1) Note. The coating bath composition may include organic material as long as the resultant coating is limited to inorganic material.

491 With heat treatment of coating:
This subclass is indented under subclass 490. Process in which the coating is heated to effect a desired change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
478, for an electrophoretic or electro-osmotic coating or forming process with use of radiation energy.
487+, 493+, 500+, 507, and 509, for other electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

492 Anodic processes only:
This subclass is indented under subclass 489. Processes in which the bath composition is specifically directed to use in anodic processes only (i.e., anionic compositions).

(1) Note. Processes involving compositions which are suitable for both anodic and cathodic processes are excluded from this subclass and the subclasses indented hereunder.

493 With heat treatment of coating:
This subclass is indented under subclass 492. Process in which the coating is heated to effect a desired change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
478, for an electrophoretic or electro-osmotic coating or forming process with use of radiation energy.
487+, 491, 500+, 507, and 509, for other electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

494 And washing, rinsing, or drying of coating:
This subclass is indented under subclass 493. Process in which the coating is also washed, rinsed, or dried, usually before heat treatment.

495 With pretreatment of substrate or bath:
This subclass is indented under subclass 492. Process in which either the substrate or the coating bath is treated to prepare for the coating process.

(1) Note. Placement in this subclass requires positive recitation of one or more pretreatment steps and does not provide for the mere use of a substrate or bath composition which was previously made by an unrecited method.

(2) Note. Pretreatment appropriate for this subclass includes: coating of individual particles which are subsequently electrophoretically coated onto a substrate, chemical reaction to prepare a bath for electrophoresis, and prewetting of a substrate to enhance bonding of an electrophoretic coating. This subclass is not intended to provide for mere mixing of a coating bath unless combined with clear recitation of a treatment to chemically or otherwise alter the bath to promote subsequent coating of at least a part thereof onto a substrate.

SEE OR SEARCH THIS CLASS, SUBCLASS:
510, for other electrophoretic or electro-osmotic coating processes with pretreatment of the substrate.

496 Bath contains shading or coloring agent (e.g., pigment, etc.):
This subclass is indented under subclass 492. Process in which the bath used for coating contains a white, black, or colored material which imparts a shade or color to the bath or to the resultant coating (e.g., pigment, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
503, for a cathodic electrophoretic or electro-osmotic coating process using a bath containing a shading or coloring agent and an epoxy or epoxide.
508, for other electrophoretic or electro-osmotic coating processes using a bath having a DCC and containing a shading or coloring agent, metal oxide, free metal, or free carbon.

497 Bath contains surface active agent (e.g., soap or detergent, wetting or emulsifying agent, etc.):
This subclass is indented under subclass 492. Process in which the bath used for coating contains a surface active agent (e.g., soap or detergent, wetting or emulsifying agent, etc.).

498 Bath contains carboxyl group:
This subclass is indented under subclass 492. Process in which the bath used for coating contains an organic compound having a carboxyl group (C=O)-OH.

499 Cathodic processes only:
This subclass is indented under subclass 489. Process in which the bath composition is specifically directed to use in cathodic processes only (i.e., cationic compositions).

(1) Note. Processes involving compositions which are suitable for both anodic and cathodic processes are excluded from this subclass and the subclasses indented hereunder.

500 With heat treatment of coating:
This subclass is indented under subclass 499. Process in which the coating is heated to effect a desired change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
478, for an electrophoretic or electro-osmotic coating or forming process with use of radiation energy.
487+, 491, 493+, 507, and 509, for other electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

501 Bath contains epoxy or epoxide:
This subclass is indented under subclass 500. Process in which the bath used for coating contains an oxirane or any other compound with an -O- bridge attached to two different carbon atoms which are also united in some other way, either directly or indirectly (e.g., epoxy resin, cyclic ether, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
502+, for other cathodic electrophoretic or electro-osmotic coating processes using a bath containing an epoxy or an epoxide.

502 Bath contains epoxy or epoxide:
This subclass is indented under subclass 499. Process in which the bath used for coating contains an oxirane or any other compound with an -O- bridge attached to two different carbon atoms which are also united in some other way, either directly or indirectly (e.g., epoxy resin, cyclic ether, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
501, for a cathodic electrophoretic or electro-osmotic coating process using a bath containing an epoxy or an epoxide combined with heat treatment of the coating.

503 And shading or coloring agent:
This subclass is indented under subclass 502. Process in which the bath used for coating also contains a white, black, or colored material which imparts a shade or color to the bath or to the resultant coating (e.g., pigment, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

496, for an anodic electrophoretic or electro-osmotic coating process using a bath containing a shading or coloring agent.

508, for other electrophoretic or electro-osmotic coating processes using a bath having a DCC and containing a shading or coloring agent, metal oxide, free metal, or free carbon.

504 And separate crosslinking or curing agent:

This subclass is indented under subclass 502. Process in which the bath used for coating also contains a separate compound or element intended to enhance crosslinking or curing of the coating.

(1) Note. For the purposes of this subclass and the subclass indented hereunder, the presence of a separate crosslinking or curing agent (i.e., not chemically bound to a composition to be coated) must be positively recited.

SEE OR SEARCH THIS CLASS, SUBCLASS:

506, for other cathodic electrophoretic or electro-osmotic coating processes using a bath containing a separate crosslinking or curing agent.

505 Isocyanate:

This subclass is indented under subclass 504. Process in which the crosslinking or curing agent is an isocyanate.

506 Bath contains separate crosslinking or curing agent:

This subclass is indented under subclass 499. Process in which the bath used for coating contains a separate compound or element intended to enhance crosslinking or curing of the coating.

(1) Note. For the purposes of this subclass, the presence of a separate crosslinking or curing agent (i.e., not chemically bound to a composition to be coated) must be positively recited.

SEE OR SEARCH THIS CLASS, SUBCLASS:

504+, for a cathodic electrophoretic or electro-osmotic coating process using a bath containing both an epoxy or an epoxide and a separate crosslinking or curing agent.

507 With posttreatment of coating (e.g., heat treatment, washing, drying, etc.):

This subclass is indented under subclass 489. Process in which the coating is subsequently treated (e.g., heat treatment, washing, drying, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

478, for an electrophoretic or electro-osmotic coating or forming process with use of radiation energy.

487+, 491, 493+, 500+, and 509, for other electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

508 Bath contains shading or coloring agent, metal oxide, free metal, or free carbon:

This subclass is indented under subclass 489. Process in which the bath used for coating contains a metal oxide, free metal, free carbon, or a white, black, or colored material which imparts a shade or color to the bath or resultant coating (e.g., pigment, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

496, for an anodic electrophoretic or electro-osmotic coating process using a bath containing a shading or coloring agent.

503, for a cathodic electrophoretic or electro-osmotic coating process using a bath containing a shading or coloring agent and an epoxy or epoxide.

509 With heat treatment of coating:

This subclass is indented under subclass 471. Process in which the coating is heated to effect a desired change therein (e.g., firing, baking, sintering, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

478, for an electrophoretic or electro-osmotic coating or forming process with use of radiation energy.

487+, 491, 493+, 500+, and 507, for other electrophoretic or electro-osmotic coating processes with heat treatment of a coated layer.

510 With pretreatment of substrate (e.g., cleaning, wetting, etc.):

This subclass is indented under subclass 471. Process in which the substrate is treated to prepare it for coating (e.g., cleaning, wetting, etc.).

(1) Note. Placement in this subclass requires positive recitation of one or more pretreatment steps and does not provide for the mere use of a substrate which was previously made or treated by an unrecited method.

SEE OR SEARCH THIS CLASS, SUBCLASS:

495, for an anodic electrophoretic or electro-osmotic coating process with pretreatment of the substrate or bath.

511 Using liquid jet:

This subclass is indented under subclass 471. Process in which a stream of liquid containing a composition for electrophoretic or electro-osmotic coating (e.g., of suspended particles, etc.) is directed onto the substrate during coating.

512 Continuous movement of substrate through bath:

This subclass is indented under subclass 471. Process in which the substrate is continuously transported in, through, and out of the bath; with an electrophoretic or electro-osmotic coating being applied to the substrate while it is moving through the bath.

(1) Note. The substrate does not need to be of indeterminate length, provided that it is kept in motion through the bath while being coated.

513 Hydrocarbon oil separated or purified:

This subclass is indented under subclass 450. Process directed to the separation or purification of hydrocarbon oil.

SEE OR SEARCH THIS CLASS, SUBCLASS:

559+, for electrical separation or purification of a liquid hydrocarbon (including hydrocarbon oil) not involving electrolysis, electrophoresis, or electro-osmosis.

SEE OR SEARCH CLASS:

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 696 for electrolytic material treatment of hydrocarbon oil.

208, Mineral Oils: Processes and Products, for processes of treatment and preparation of mineral oils employing mere electrical thermal effects.

514 Aqueous system:

This subclass is indented under subclass 513. Process in which the hydrocarbon oil is in an aqueous system.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

515 Inorganic siliceous or calcareous material prepared, separated, or treated (e.g., clay, earth, concrete, asbestos, glass, etc.):

This subclass is indented under subclass 450. Process involving preparation, separation, or treatment of a material containing silica or cal-

cium (e.g., clay, earth, concrete, asbestos, glass, etc.).

SEE OR SEARCH CLASS:

34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for drying and gas or vapor contacting of solids, in general, especially subclass 1 for processes and apparatus involving the subjection of solids to electrical energy; but not involving electrolysis, electrophoresis, or electro-osmosis.

516 Barrier separation (e.g., using membrane, filter paper, etc.):

This subclass is indented under subclass 515. Process in which a barrier (e.g., membrane, filter paper, etc.) is used to separate some ions or particles from other ions or particles by allowing some ions or particles to pass through the barrier while the others are retained at or stopped from passing through the barrier.

(1) Note. This subclass and the subclass indented hereunder are not intended to provide for the mere use of a perforated electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

518+, for electrophoretic or electro-osmotic barrier separation of other materials.

517 Ion selective:

This subclass is indented under subclass 516. Process in which the barrier distinguishes between ions of different charges to effect separation.

(1) Note. Methods which distinguish between ions having different levels of positive or negative charge are included here as well as those distinguishing between positive and negative charges.

(2) Note. Use of ion exchange membranes to effect separation is included in this group.

SEE OR SEARCH THIS CLASS, SUBCLASS:

520+, for electrophoretic or electro-osmotic ion selective barrier separation of other materials.

518 Barrier separation (e.g., using membrane, filter paper, etc.):

This subclass is indented under subclass 450. Process in which a barrier (e.g., membrane, filter paper, etc.) is used to separate some ions or particles from other ions or particles by allowing some ions or particles to pass through the barrier while the others are retained at or stopped from passing through the barrier.

(1) Note. This subclass and the subclasses indented hereunder are not intended to provide for the mere use of a perforated electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

516+, for electrophoretic or electro-osmotic barrier separation of inorganic siliceous or calcareous material.

627+, for corresponding apparatus.

519 With control responsive to sensed condition:

This subclass is indented under subclass 518. Process in which the barrier separation is regulated by detecting a characteristic or a change in a characteristic of the process and by implementing an action in the process based upon the detected characteristic or change therein.

(1) Note. In this subclass and the subclasses indented hereunder a single means may be used both to detect a characteristic or a change in a characteristic of the process and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

472+, for electrophoretic or electro-osmotic coating or forming with control responsive to sensed condition.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though non-electrical values may be derived from the electrical properties determined.

520 Ion selective:

This subclass is indented under subclass 518. Process in which the barrier distinguishes between ions of different charges to effect separation.

(1) Note. Methods which distinguish between ions having different levels of positive or negative charge are included here as well as those distinguishing between positive and negative charges.

(2) Note. Use of permiselective membranes or ion exchange materials to effect separation is included in this group.

SEE OR SEARCH THIS CLASS, SUBCLASS:

517, for electrophoretic or electro-osmotic ion selective barrier separation of inorganic siliceous or calcareous material.

521 Combined with manufacture or pretreatment of barrier:

This subclass is indented under subclass 520. Process which includes one or more steps of manufacture or pretreatment of the barrier.

SEE OR SEARCH THIS CLASS, SUBCLASS:

470, for gel electrophoresis or gel composition therefor combined with manufacture or preparation of the gel.

522 Using both anion and cation selective membranes:

This subclass is indented under subclass 520. Process in which at least one membrane selectively passes ions with a positive charge and at least one other membrane selectively passes ions with a negative charge.

523 Alternating anion and cation selective membranes:

This subclass is indented under subclass 522. Process in which at least 3 anion and cation selective membranes are employed in an alternating sequential array (e.g., 2 anion selective membranes separated by a cation selective membrane, etc.).

524 And using ion exchange material (e.g., suspended particles, etc.):

This subclass is indented under subclass 523. Process in which ion exchange material (e.g., suspended particles, etc.) is also used.

SEE OR SEARCH THIS CLASS, SUBCLASS:

481, for electrophoretic or electro-osmotic coating or forming with regeneration or replenishment of the coating bath using ion exchange material.

536, for electrophoretic or electro-osmotic ion selective barrier separation combined with the use of ion exchange material, but not using both anion and cation selective membranes.

542, for other electrophoretic or electro-osmotic barrier separation processes combined with a diverse-type separation.

525 With prevention of scale buildup or fouling of membrane:

This subclass is indented under subclass 523. Process in which action is taken to prevent accumulation of scale or fouling substances on a membrane or other internal components of a chamber used during separation.

(1) Note. This subclass is not intended to provide for mere recycling of process fluid unless specifically recited to prevent scale buildup or fouling of a membrane.

526 Gas or vapor treated:
This subclass is indented under subclass 523. Process in which a gas or vapor is treated.

527 Biological material prepared, recovered, or treated (e.g., urine, etc.):
This subclass is indented under subclass 523. Process in which biological material is prepared, recovered, or treated (e.g., urine, etc.).

(1) Note. This subclass does not provide for electro-osmotic barrier separation involving preparation, recovery, or treatment of a fluid (e.g., air, carbon dioxide, etc.) which may be metabolized or may be the result of a metabolic process unless the fluid is specifically disclosed in connection with a metabolic or biological process or organism.

SEE OR SEARCH THIS CLASS, SUBCLASS:
540, for other electrophoretic or electro-osmotic ion selective barrier separation of biological material.
543, for electrophoretic or electro-osmotic nonion selective barrier separation of biological material.

528 Regeneration of liquid electrolyte:
This subclass is indented under subclass 523. Process in which a desired liquid electrolyte solution is rejuvenated.

SEE OR SEARCH THIS CLASS, SUBCLASS:
480+, for electrophoretic or electro-osmotic coating or forming with regeneration or replenishment of the coating bath.

SEE OR SEARCH CLASS:
430, Radiation Imagery Chemistry: Processes, Composition, or Product Thereof, especially subclasses 398+ for regeneration of image processing compositions (e.g., regeneration of photos:graphic solutions, etc.).

529 Metal or metal salt recovered or removed:
This subclass is indented under subclass 523. Process in which a metal or metal salt is recovered or removed.

530 Organic material prepared, recovered, or treated:
This subclass is indented under subclass 523. Process in which organic material is prepared, recovered, or treated.

SEE OR SEARCH THIS CLASS, SUBCLASS:
541, for other electrophoretic or electro-osmotic ion selective barrier separation of organic material.
544, for electrophoretic or electro-osmotic nonion selective barrier separation of organic material.

531 Acid prepared, recovered, or treated:
This subclass is indented under subclass 523. Process in which an acid is intentionally prepared, recovered, or treated.

(1) Note. This subclass is not intended to provide for the mere use of an acid unless it is also intentionally separated by electrophoresis or electro-osmosis using alternating anion and cation selective membranes.

532 And using nonion selective membrane:
This subclass is indented under subclass 522. Process which also uses at least one membrane which does not exhibit ion selectivity.

SEE OR SEARCH THIS CLASS, SUBCLASS:
535, for electrophoretic or electro-osmotic ion selective barrier separation which also uses a nonion selective membrane, but does not employ both anion and cation selective membranes.

533 And using ion exchange material (e.g., suspended particles, etc.):
This subclass is indented under subclass 522. Process in which ion exchange material (e.g., suspended particles, etc.) is also used.

SEE OR SEARCH THIS CLASS, SUBCLASS:
481, for electrophoretic or electro-osmotic coating or forming with regeneration or replenishment of the coating bath using ion exchange material.

524, for electrophoretic or electro-osmotic ion selective barrier separation using alternating anion and cation selective membranes combined with the use of ion exchange material.

536, for electrophoretic or electro-osmotic ion selective barrier separation combined with the use of ion exchange material, but without using both anion and cation selective membranes.

542, for other electrophoretic or electro-osmotic barrier separation processes combined with a diverse-type separation.

534 And using bipolar membrane:

This subclass is indented under subclass 522. Process in which a membrane having anionic properties on one side and cationic properties on the other is used in combination with both anion and cation selective membranes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

537, for electrophoretic or electro-osmotic ion selective barrier separation using a bipolar membrane, but not using both anion and cation selective membranes.

535 And using nonion selective membrane:

This subclass is indented under subclass 520. Process which also uses at least one membrane which does not exhibit ion selectivity.

SEE OR SEARCH THIS CLASS, SUBCLASS:

532, for electrophoretic or electro-osmotic ion selective barrier separation which uses a nonion selective membrane, but also employs both anion and cation selective membranes.

536 And using ion exchange material (e.g., suspended particles, etc.):

This subclass is indented under subclass 520. Process in which ion exchange material (e.g., suspended particles, etc.) is also used.

SEE OR SEARCH THIS CLASS, SUBCLASS:

481, for electrophoretic or electro-osmotic coating or forming with regeneration or replenishment of the coating bath using ion exchange material.

524, for electrophoretic or electro-osmotic ion selective barrier separation using alternating anion and cation selective membranes combined with the use of ion exchange material.

542, for other electrophoretic or electro-osmotic barrier separation processes combined with a diverse-type separation.

537 Using bipolar membrane:

This subclass is indented under subclass 520. Process in which a membrane having anionic properties on one side and cationic properties on the other is used.

SEE OR SEARCH THIS CLASS, SUBCLASS:

534, for electrophoretic or electro-osmotic ion selective barrier separation using a bipolar membrane combined with both anion and cation selective membranes.

538 Water splitting:

This subclass is indented under subclass 537. Process in which water is broken down into hydrogen and oxygen.

539 Using anion selective membrane:

This subclass is indented under subclass 520. Process in which at least one anion selective membrane is used.

540 Biological material prepared, recovered, or treated (e.g., urine, etc.):

This subclass is indented under subclass 520. Process in which biological material is prepared, recovered, or treated (e.g., urine, etc.).

(1) Note. This subclass does not provide for electro-osmotic barrier separation involving preparation, recovery, or treatment of a fluid (e.g., air, carbon dioxide, etc.) which may be metabolized or may be the result of a metabolic process unless the fluid is specifically disclosed in connection with a metabolic or biological process or organism.

SEE OR SEARCH THIS CLASS, SUBCLASS:

527, for electrophoretic or electro-osmotic ion selective barrier separation of biological material using alternating anion and cation selective membranes.

543, for electrophoretic or electro-osmotic nonion selective barrier separation of biological material.

541 Organic material prepared, recovered, or treated:

This subclass is indented under subclass 520. Process in which organic material is prepared, recovered, or treated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

530, for electrophoretic or electro-osmotic ion selective barrier separation of organic material using alternating anion and cation selective membranes.

544, for electrophoretic or electro-osmotic nonion selective barrier separation of organic material.

542 Combined with diverse-type separation (e.g., electro-osmotic barrier separation combined with centrifugal separation, etc.):

This subclass is indented under subclass 518. Process which is combined with a separation which employs neither an electrical force (or stress) nor a separation barrier.

(1) Note. The combined diverse separations may be conducted simultaneously.

543 Biological material prepared, recovered, or treated (e.g., urine, etc.):

This subclass is indented under subclass 518. Process in which biological material is prepared, recovered, or treated (e.g., urine, etc.).

(1) Note. This subclass does not provide for electro-osmotic barrier separation involving preparation, recovery, or treatment of a fluid (e.g., air, carbon dioxide, etc.) which may be metabolized or may be the result of a metabolic process unless the fluid is specifically disclosed in connection with a metabolic or biological process or organism.

SEE OR SEARCH THIS CLASS, SUBCLASS:

527, and 540, for electrophoretic or electro-osmotic ion selective barrier separation of biological material.

544 Organic material prepared, recovered, or treated:

This subclass is indented under subclass 518. Process in which organic material is prepared, recovered, or treated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

530, and 541, for electrophoretic or electro-osmotic ion selective barrier separation of organic material.

541, for electrophoretic or electro-osmotic ion selective barrier separation of organic material.

545 With use of nonelectrical field or force to separate (e.g., magnetic, centrifugal, etc.):

This subclass is indented under subclass 450. Process in which a material is separated by electrophoresis or electro-osmosis combined with a nonelectrical field or force (e.g., magnetic, centrifugal, etc.).

(1) Note. The two combined separations may be conducted simultaneously.

546 Absorbent strip electrophoresis (e.g., using cellulose acetate, paper strip, etc.):

This subclass is indented under subclass 450. Process in which a separation by the differential migration of ions or particles takes place on a sheet or strip of absorbent material (e.g., using cellulose acetate, paper strip, etc.).

(1) Note. Use of the term “paper” broadly in a method of this type is considered proper for this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

641+, for corresponding apparatus.

547 Dielectrophoresis (i.e., using nonuniform electric field):

This subclass is indented under subclass 450. Process in which a nonuniform electric field is used to separate particles or ions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

643, for corresponding apparatus.

548 Isoelectric focusing (i.e., using pH variation):

This subclass is indented under subclass 450. Process in which a differential pH gradient is established in the medium to affect the migration of individual particles or components based on their different isoelectric points (the different pH values at which the net charge on each particle or component is neutral).

SEE OR SEARCH THIS CLASS, SUBCLASS:

459, for isoelectric focusing in gel electrophoresis.

644, for corresponding apparatus.

549 Isotachophoresis (i.e., displacement electrophoresis) or measurement of ion or particle mobility:

This subclass is indented under subclass 450. Process which involves different ion or particle mobilities (e.g., ions or particles having the same charge and given the same initial velocity are separated based on their differing net mobilities, etc.) or which merely involves measuring of ion or particle mobility.

SEE OR SEARCH THIS CLASS, SUBCLASS:

645, for corresponding apparatus.

550 Ionophoresis:

This subclass is indented under subclass 450. Process which involves the separation or removal of ions from solution by electrophoresis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

516+, for electrophoretic or electro-osmotic barrier separation of inorganic siliceous or calcareous material.

518+, for electrophoretic or electro-osmotic barrier separation of other materials.

SEE OR SEARCH CLASS:

604, Surgery, subclasses 20+ for an iontophoresis process or apparatus used to introduce ionic medication through unbroken skin under the influence of a direct electric current.

551 Solid sorption or desorption:

This subclass is indented under subclass 450. Process which involves electrophoretic or electro-osmotic solid sorption or desorption.

SEE OR SEARCH CLASS:

134, Cleaning and Liquid Contact With Solids, appropriate subclasses for cleaning and contacting solids with liquid without involving a chemical reaction brought about by electrical or wave energy, especially subclass 1 for a Class 134 process including application of electrical, radiant, or wave energy to the work (material under treatment).

252, Compositions, subclass 194 for compositions used to absorb, bind, remove, or release water.

502, Catalyst, Solid Sorbent, or Support Therefor, Product or Process of Making, subclasses 20+ for other methods, in general, of regenerating or rehabilitating a solid sorbent, per se; subclasses 60+ for zeolite compositions and processes of making zeolite compositions; and subclasses 400+ for other solid sorbent compositions and methods of making solid sorbent compositions.

553 Bulk separation of solids and liquids (e.g., dewatering solids, clarifying water, etc.):

This subclass is indented under subclass 450. Process which involves nonanalytical, large scale separation of solids and liquids (e.g., dewatering solids, clarifying water, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

648+, for corresponding apparatus.

554 Electrical (including simultaneous electrical and magnetic) separation or purification of

liquid or magnetic treatment of liquid (other than separation):

This subclass is indented under the class definition. Process involving (a) electrical (including simultaneous electrical and magnetic) separation or purification of a liquid or (b) magnetic treatment, per se, when some effect other than mere separation is desired or produced.

(1) Note. This subclass and the subclasses indented hereunder primarily provide for electrostatic separation of a liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

155+, for processes of producing a compound or element by chemical reaction brought about by electrical or wave energy in a magnetic field, except processes involving electrolysis or in which chemical reaction is brought about by the mere heating effect of electrical or wave energy.

450+, for electrophoresis or electro-osmosis processes.

660+, for corresponding apparatus.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 2+ and 57+ for electric field separation of gaseous mixtures (including degasifying of liquid) without involving chemical reaction to convert one or more constituents to other compounds; but simultaneous or sequential combinations of electrical degasification of a liquid with other electrical separation of a liquid are provided for in Class 205 when electrolysis is involved or in Class 204 when electrolysis is not involved (this remains true for placement of such combined processes regardless of whether a chemical reaction is or is not involved).

205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, for electrolytic processes.

208, Mineral Oils: Processes and Products, for processes of purifying mineral oils (including removing water) without using electrical or wave energy (other than mere electrical heating which is provided for in Class 208) and as long as more than mere physical separation (provided for in Class 210, subclasses 767+) is involved. Also, see the line notes above and below drawn to Classes 205 and 210 for other loci providing for processes of treating emulsions or dispersions. And see Class 516 for discussion of the placement of colloid systems (e.g., emuision, dispersion, gels) in the US Patent Classification System.

210, Liquid Purification or Separation, subclass 748 for general purification or separation of a liquid, especially water or waste water, utilizing electrical or wave energy (except the type provided for in Classes 204 or 205, unless (1) the Class 204 or Class 205 process is merely used to produce a reagent employed in a process otherwise provided for in Class 210 above subclasses 767+ (e.g., electrolytic production of free chlorine in salt water which is employed to sterilize the salt water under treatment, etc.) or (2) the 204 or 205 type process includes at least one separate step provided for in Class 210 above subclasses 767+ and except for general disinfecting, preserving, deodorizing, or sterilizing (as provided for in Class 422, subclasses 1+) of a medium other than liquid water or waste water (e.g., Class 210, subclass 748, provides for the use of ultraviolet light to sterilize, and therefor purify, liquid water, etc.)); and appropriate other subclasses for breaking or coalescing of oil/water emulsions which may involve the use of a magnetic field, but without using an electric field. Also, see the line notes above drawn to Classes 205 and 208 for other loci providing for processes of treating emulsions or dispersions. And see Class 516 for discussion of the placement of colloid systems (e.g., emulsion, dispersion, gels) in the US Patent Classification System.

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 1+ for general disinfecting, preserving, deodorizing or sterilizing, especially subclasses 20, 21, and 22+ for disinfecting, preserving, or sterilizing using electrical or wave energy in a way not provided for in another class (e.g., electrostatic sterilizing (involving a chemical reaction) of a gas, etc.).

435, Chemistry: Molecular Biology and Microbiology, for a process or apparatus involving measuring or testing by electrical or wave energy which is separate and apart, but in combination with a process or apparatus for use with a viable micro-organism or a catalytically active enzyme; and for a process or apparatus involving electrical or wave energy treatment of a micro-organism or an enzyme when the treatment is solely disclosed for use with a viable micro-organism or a catalytically active enzyme.

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, appropriate subclasses for subject matter relating to: colloid systems (such as sols*, emulsions, dispersions, foams, aerosols, smokes, gels, or pastes) or wetting agents (such as leveling, penetrating, or spreading); subcombination compositions of colloid systems containing at least an agent specialized and designed for or peculiar to use in making or stabilizing colloid systems; compositions and subcombination compositions specialized and designed for or peculiar to use in breaking (resolving) or inhibiting colloid systems; processes of making the compositions or systems of the class; processes of breaking (resolving) or inhibiting colloid systems; in each instance, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art; when without using electrical or wave energy.

555 With control responsive to sensed condition: This subclass is indented under subclass 554. Process in which the separation or purification is regulated by detecting a characteristic or a change in a characteristic of the process and by implementing an action in the process based upon the detected characteristic or change therein.

(1) Note. In this subclass and the subclasses indented hereunder a single means may be used both to detect a characteristic or a change in a characteristic of the process and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

556, for electrical separation or purification of liquid with measuring, testing, or sensing; but without control responsive to sensed condition.

661, for corresponding apparatus.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though non-electrical values may be derived from the electrical properties determined.

556 With measuring, testing, or sensing: This subclass is indented under subclass 554. Process which includes measuring, detecting, or testing a characteristic, condition, or property of the process or an element used in the process.

SEE OR SEARCH THIS CLASS, SUBCLASS:

555, for electrical separation or purification of liquid with control responsive to sensed condition.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though nonelectrical values may be derived from the electrical properties determined.

557 Using magnetic field:

This subclass is indented under subclass 554. Process in which magnetic lines of force are used to separate a constituent, to aid the separation of a constituent from a liquid, or to treat a liquid without resulting in separation or purification.

(1) Note. This subclass provides for (a) simultaneous electrical and magnetic separation processes and (b) magnetic treatment, per se, when some effect other than mere separation is desired or produced.

SEE OR SEARCH THIS CLASS, SUBCLASS:

155+, for processes of producing compounds or elements by chemical reaction brought about by electrical or wave energy in a magnetic field; except processes involving electrolysis or in which chemical reaction is brought about by the mere heating effect of electrical or wave energy.

664, for corresponding apparatus.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclass 27 and 28 for magnetic separation of gaseous mixtures without involving chemical reaction to convert one or more constituents to other compounds.

210, Liquid Purification or Separation, subclass 695 for magnetic separation of a liquid, per se, or combined with a separate step of electrical separation.

558 With simultaneous use of liquid-liquid extraction solvent:

This subclass is indented under subclass 554. Process characterized by the presence of a liquid-liquid solvent capable of removing a liquid constituent from a liquid mixture by preferential dissolution or miscibility of the liquid constituent into the liquid-liquid solvent.

(1) Note. This subclass is intended to include processes using such a liquid-liquid solvent for any purpose, even if there is no disclosure of actual transfer of a liquid constituent from the liquid mixture into the liquid-liquid solvent.

(2) Note. The liquid-liquid solvent extraction and electrical separation or purification must occur simultaneously. See the search class note to Class 210 below.

SEE OR SEARCH CLASS:

210, Liquid Purification or Separation, subclasses 634+ for liquid-liquid solvent extraction, per se, or combined with a separate step of electrical treatment.

559 Predominantly hydrocarbon:

This subclass is indented under subclass 554. Process in which the liquid to be separated or purified is predominantly made up of one or more chemical compounds containing only atoms of carbon and hydrogen such that the total hydrocarbon content is greater than that of any single nonhydrocarbon constituent in the liquid (e.g., separating or purifying a liquid mixture containing 20% hexane, 20% octane, 30% water, 25% acetone, and 5% ethanol, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

513+, for electrophoretic or electro-osmotic separation or purification of hydrocarbon oil.

560 Removing solids:
This subclass is indented under subclass 559. Process in which solid material is removed from the liquid under treatment.

(1) Note. Very small single cell biological entities (e.g., bacteria, etc.) are not considered to be solid material for the purposes of this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:
571+, for electrical separation or purification to remove solids from other liquids.

561 With addition of agent to facilitate removal:
This subclass is indented under subclass 560. Process in which a material is added to the liquid under treatment to clearly aid removal of solids therefrom.

(1) Note. The addition of an agent for this subclass is more restricted than the mere use of a modifying agent in resolving an emulsion or dispersion as provided for in subclasses 567+.

562 Using cohesive filter or solid packing:
This subclass is indented under subclass 560. Process in which a cohesive filter medium or bed of solid packing elements is used to remove the solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:
572, for electrical separation or purification of other liquids using a cohesive filter or solid packing.

563 Resolving emulsion or dispersion:
This subclass is indented under subclass 559. Process which involves breaking an emulsion or dispersion by agglomerating or accreting suspended constituents.

(1) Note. The emulsion or dispersion may either be initially present or formed during a previous process step.

SEE OR SEARCH THIS CLASS, SUBCLASS:
573, for electrical separation or purification of other liquids by resolving an emulsion or dispersion.

SEE OR SEARCH CLASS:
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

564 Using interrupted or pulsed direct current field:
This subclass is indented under subclass 563. Process in which the emulsion or dispersion is resolved using an electric field produced by a direct current which is periodically interrupted or pulsed.

(1) Note. An interrupted or pulsed direct current field is often used to reduce short circuiting by inhibiting the alignment of conducting constituents in the emulsion or dispersion between opposing electrodes.

SEE OR SEARCH CLASS:
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in

the USPC for the specifically claimed art, when without using electrical or wave energy.

565 Using modified alternating current (other than standard 50 Hz or 60 Hz sine wave) field:

This subclass is indented under subclass 564. Process in which the emulsion or dispersion is resolved using an electric field produced by a modified alternating current with a frequency or wave form other than that of standard 50 Hz or 60 Hz sine wave alternating current (e.g., other than standard pure or simple alternating current, etc.).

(1) Note. A modified alternating current field is often used to reduce short circuiting by inhibiting the alignment of conducting constituents in the emulsion or dispersion between opposing electrodes.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

567 Using modifying agent:

This subclass is indented under subclass 563. Process in which a gaseous, liquid, or solid material is used to change the physical or electrical characteristics of the emulsion or dispersion.

(1) Note. This subclass and the subclasses indented hereunder are intended to be interpreted broadly, including processes in which the modifying agent may be used merely as a carrier for one or more system constituents.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

568 Gas or vapor:

This subclass is indented under subclass 567. Process in which the modifying agent is a gas or vapor.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

569 Dielectric liquid:

This subclass is indented under subclass 567. Process in which the modifying agent is a nonconducting or insulating liquid (e.g., hydrocarbon oil, etc.).

(1) Note. The terms “dielectric,” “nonconducting,” “insulating,” or their equivalents used in connection with an added modifying agent are sufficient for placement in this subclass. If the dielectric functionality of such an added modify-

ing agent is in doubt, placement is proper for the broad subclass, 567.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

570 Water:

This subclass is indented under subclass 567. Process in which the modifying agent consists of substantially pure water (i.e., containing only mere incidental impurities).

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

571 Removing solids:

This subclass is indented under subclass 554. Process in which solid material is removed from the liquid under treatment.

(1) Note. Very small, single-cell, biological entities (e.g., bacteria, etc.) are not considered to be solid material for the purposes of this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

560+, for electrical separation or purification to remove solids from liquid hydrocarbons.

572 Using cohesive filter or solid packing:

This subclass is indented under subclass 571. Process in which a cohesive filter medium or bed of solid packing elements is used to remove the solids.

SEE OR SEARCH THIS CLASS, SUBCLASS:

562, for electrical separation or purification of liquid hydrocarbons using a cohesive filter or solid packing.

573 Resolving emulsion or dispersion:

This subclass is indented under subclass 554. Process which involves breaking an emulsion or dispersion by agglomerating or accreting suspended constituents.

(1) Note. The emulsion or dispersion may either be initially present or formed during a previous process step.

SEE OR SEARCH THIS CLASS, SUBCLASS:

563+, for electrical separation or purification of liquid hydrocarbons by resolving an emulsion or dispersion.

SEE OR SEARCH CLASS:

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art, when without using electrical or wave energy.

600 Electrophoretic or electro-osmotic apparatus:

This subclass is indented under subclass 193. Apparatus used to conduct processes involving (a) the travel, transport, or relative movement of one or more particles or components in a conducting liquid or fluent material, other than a gas, under a net unidirectional electric stress or (b) the movement of a liquid inside the capillary spaces of a solid (e.g., membrane, etc.) under the influence of an electric field.

(1) Note. For the purpose of Class 204, "electrophoresis" is restricted to situations where the liquid or fluent material is electrically conductive and wherein there is at least one electrolytic phenomenon (e.g., electrode gas formation, etc.) inherently or otherwise taking place simultaneously with the electromigration of particles.

(2) Note. "Electrophoretic display devices" or other systems which employ an electrostatic field or a dielectric suspending liquid or fluent material for particles undergoing motion are more properly classified in the appropriate electrical class (e.g., 355, 358, 359, etc.).

(3) Note. In electrophoresis, the moved particles usually are electrically charged.

SEE OR SEARCH THIS CLASS, SUBCLASS:

194+, for electrolytic apparatus.
450+, for corresponding processes of electrophoresis or electro-osmosis.
660+, for electrical apparatus used to separate or purify liquids.

SEE OR SEARCH CLASS:

340, Communications: Electrical, appropriate subclasses for subject matter relating to electrical communications which is not provided for elsewhere.
356, Optics: Measuring and Testing, subclass 344 for processes and apparatus for testing the change in the refractive index of a fluid in an electrophoresis cell and subclasses 128+ for other refraction testing processes and apparatus therefor.
358, Facsimile and Static Presentation Processing, for data processing for presentation to printer, and facsimile system.
359, Optics: Systems (Including Communication) and Elements, appropriate subclasses for optical elements and systems not provided for elsewhere.
399, Electrophotography, subclasses 9+ for diagnostics, subclasses 38+ for controls, subclasses 130+ for image formation, subclasses 168+ for charging, subclasses 177+ for exposure, subclasses 222+ for development, subclasses 297+ for transfer, subclasses 320+ for fixing, subclasses 343+ for cleaning, and subclasses 361+ for document handling.

601 Capillary electrophoresis type:

This subclass is indented under subclass 600. Apparatus having a tube with an inside diameter less than 1 mm in which particles or components migrate in an electric field through a conducting liquid or fluent material.

(1) Note. For classification in this subclass and the subclasses indented hereunder, a "capillary" or very small tube of undisclosed inside diameter is presumed to be small enough.

602 With control means responsive to sensed condition:

This subclass is indented under subclass 601. Apparatus in which means are provided to detect an apparatus or process characteristic or change therein and to control or regulate operation of the apparatus or process based on the detected characteristic or change therein.

(1) Note. A single means may be used both to detect an apparatus or process characteristic or a change in a characteristic and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

607, for gel electrophoresis-type apparatus with control means responsive to sensed condition.

628, for electrophoretic or electro-osmotic apparatus using a barrier separator with control means responsive to sensed condition.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous systems for controlling the current and/or voltage in a single circuit.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though non-electrical values may be derived from the electrical properties determined.

603 With detailed detection system (e.g., including a light source and a camera, etc.):

This subclass is indented under subclass 601. Apparatus which provides for a detection system recited in more detail than merely nominal mention (e.g., including a light source and a camera, etc.).

(1) Note. This subclass is not intended to provide for apparatus merely having a plotter or a recording device without including at least one detailed detector element or device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

612, for gel electrophoresis-type apparatus with a detailed detection system.

604 With injector:

This subclass is indented under subclass 601. Apparatus having means to inject material to be tested or treated into the capillary, usually by electro-osmotic bulk flow.

605 Gel filled:

This subclass is indented under subclass 601. Apparatus in which the inner bore of the capillary is filled with a jellylike colloidal solution of liquid in a solid (usually organic).

(1) Note. This subclass is not intended to provide for a capillary filled with an inorganic solid (e.g., silica gel, etc.) which is not present as a jellylike colloidal solution of a liquid in the solid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

606, for gel electrophoresis-type apparatus without a capillary.

606 Gel electrophoresis type:

This subclass is indented under subclass 600. Apparatus in which particles or components migrate in an electric field within a continuous medium of a jellylike colloidal solution of liquid in a solid (usually organic).

(1) Note. This subclass and the subclasses indented hereunder are not intended to provide for a continuous medium of an inorganic solid (e.g., silica gel, etc.) which is not present as a jellylike colloidal solution of a liquid in the solid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

605, for gel electrophoresis-type apparatus using a capillary filled with organic gel.

607 With control means responsive to sensed condition:

This subclass is indented under subclass 606. Apparatus in which means are provided to detect an apparatus or process characteristic or change therein and to control or regulate operation of the apparatus or process based on the detected characteristic or change therein.

(1) Note. A single means may be used both to detect an apparatus or process characteristic or a change in a characteristic and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

602, for capillary electrophoresis-type apparatus with control means responsive to sensed condition.

628, for electrophoretic or electro-osmotic apparatus using a barrier separator with control means responsive to sensed condition.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous systems for controlling the current and/or voltage in a single circuit.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though nonelectrical values may be derived from the electrical properties determined.

608 With programmed, cyclic, or time responsive control means:

This subclass is indented under subclass 606. Apparatus which is provided with control means for (a) storing coded instructions or other data which is used to regulate operation of the treating apparatus, (b) repetitively regulating a sequence of operational steps performed in or by the treating apparatus, or (c) causing various system operations to occur according to preset timing sequences or to last for predetermined durations of time (e.g., timer switches, etc.).

(1) Note. This subclass and the subclass indented hereunder includes any control means which maintain an operating condition, predetermine apparatus operation, or regulate repetition.

(2) Note. This subclass and the subclass indented hereunder are not intended to provide for apparatus merely using alternating current (AC), per se.

609 Plural rapid changes in direction of electric field (at least 1,000 times total and at more than 1/sec) (e.g., pulsed field, etc.):

This subclass is indented under subclass 608. Apparatus in which the electric field changes direction more than 1,000 times in rapid succession (more than 1 change per second), usually using more than 2 electrodes with synchronized timing of voltage spikes or peaks.

610 Isoelectric focusing (i.e., using pH variation):

This subclass is indented under subclass 606. Apparatus in which a pH gradient is established in the medium to affect the migration of different particles or components based on their isoelectric points (the point having a pH at which the net charge on the particle or component is neutral).

SEE OR SEARCH THIS CLASS, SUBCLASS:

644, for nongel-type isoelectric focusing apparatus.

612 With detailed detection system (e.g., including a light source and a camera, etc.):

This subclass is indented under subclass 606. Apparatus which provides for a detection system recited in more detail than merely nominal mention (e.g., including a light source and a camera, etc.).

(1) Note. This subclass is not intended to provide for apparatus merely having a plotter or a recording device without including at least one detailed detector element or device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

603, for capillary electrophoresis-type apparatus with a detailed detection system.

613 With means for post treatment of gel to purify or recover a desired component:

This subclass is indented under subclass 606. Apparatus having means to subsequently purify or recover a desired component from the gel.

614 Blotter (e.g., membrane, etc.):

This subclass is indented under subclass 613. Apparatus having means to transfer one or more components from the gel to an adjacent receiving medium (e.g., membrane, etc.).

(1) Note. The transfer may be assisted by an external force (e.g., hydraulic pressure, electric field, etc.).

615 Unitary preparation apparatus (e.g., preparative means, etc.):

This subclass is indented under subclass 606. Apparatus comprised of a single unit designed to yield a product in final form (e.g., for analyzing results, etc.), precluding the need for additional means to subsequently treat or transfer separated species.

(1) Note. The preparative nature of gel electrophoresis or an apparatus used therein must be specifically recited for placement in this subclass.

616 Slab gel:

This subclass is indented under subclass 606. Apparatus in which the gel is planar in form (e.g., rectangular sheet, etc.).

617 Curved:

This subclass is indented under subclass 616. Apparatus in which the slab gel is in the form of an arc (including annular slabs).

618 Vertical or inclined:

This subclass is indented under subclass 616. Apparatus in which the slab gel is in an upright position or is tipped up during use (e.g., vertical slab, etc.).

619 With gel shaping or molding means (e.g., comb, ribbed insert, gel injectors, etc.):

This subclass is indented under subclass 618. Apparatus provided with means to form or cast the gel, usually prior to use in gel electrophoresis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

620, for slab gel electrophoresis-type apparatus with a gel shaping or molding means in which the gel slab is not positioned vertically or inclined during use.

620 With gel shaping or molding means (e.g., comb, ribbed insert, gel injectors, etc.):

This subclass is indented under subclass 616. Apparatus provided with means to form or cast the gel, usually prior to use in gel electrophoresis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

619, for vertical or inclined slab gel electrophoresis-type apparatus with a gel shaping or molding means.

621 With liquid heat exchange means to cool gel slab during electrophoresis:

This subclass is indented under subclass 616. Apparatus having means to transfer heat during electrophoresis from the gel slab to a cooling liquid.

622 Coating or forming means:

This subclass is indented under subclass 600. Apparatus having means to coat a substrate or form an object by electrophoresis or electroosmosis.

(1) Note. An electrophoretic forming apparatus is defined herein as an electrophoretic coating apparatus also having means to subsequently remove the coated layer from the coated substrate.

SEE OR SEARCH THIS CLASS, SUBCLASS:

194+, for electrolytic coating or forming apparatus.

298.01+, for sputter coating or forming apparatus.

471+, for corresponding processes.

SEE OR SEARCH CLASS:

34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for apparatus used to dry solids by other than electrolysis, electrical, or wave energy.

118, Coating Apparatus, subclasses 620+ for apparatus for applying a coating electrostatically, where the medium is not electroconductive.

399, Electrophotography, for electronphotographic apparatus.

623 With moving or movable electrode:

This subclass is indented under subclass 622. Apparatus in which an electrode is either moving or movable.

SEE OR SEARCH THIS CLASS, SUBCLASS:

198, through 226, for electrolytic apparatus with movable electrode means.

629, for an electrophoretic or electro-osmotic barrier separator with a moving or movable electrode.

649, for an electrophoretic or electro-osmotic bulk separator for solids and liquids with a moving or movable electrode.

650, for electrophoretic or electro-osmotic apparatus with a moving or movable electrode, in general.

668+, for electrical apparatus used to separate or purify liquid equipped with a moving or movable electrode.

624 And means for posttreatment of coating (e.g., drying, heating, curing, etc.):

This subclass is indented under subclass 623. Apparatus which is also provided with means to treat a coated layer after it is produced (e.g., drying, heating, curing, etc.).

625 Coating interior of object or article (e.g., water main, automobile body, etc.):

This subclass is indented under subclass 623. Apparatus having means to produce a coating on the interior of an object or article (e.g., water main, automobile body, etc.).

626 With means for regeneration or replenishment of coating bath or electrolyte:

This subclass is indented under subclass 622. Apparatus having means for regeneration, purification, or concentration adjustment of the coating bath or electrolyte.

627 Barrier separator (e.g., electrodialyzer, etc.):

This subclass is indented under subclass 600. Apparatus having a filter or membrane (e.g., electrodialyzer, etc.) to separate some ions or particles from other ions or particles by allowing some ions or particles to pass through the barrier while the others are retained at or stopped from passing through the barrier.

(1) Note. This subclass and the subclasses indented hereunder are not intended to provide for the mere use of a perforated electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

518+, for corresponding processes.

628 With control means responsive to sensed condition:

This subclass is indented under subclass 627. Apparatus in which means are provided to detect an apparatus or process characteristic or change therein and to control or regulate operation of the apparatus or process based on the detected characteristic or change therein.

(1) Note. A single means may be used both to detect an apparatus or process characteristic or a change in a characteristic and to implement an action in the process based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

602, for capillary electrophoresis-type apparatus with control means responsive to sensed condition.

607, for gel electrophoresis-type apparatus with control means responsive to sensed condition.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. See also (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous systems for controlling the current and/or voltage in a single circuit.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though non-electrical values may be derived from the electrical properties determined.

629 With moving or movable electrode:

This subclass is indented under subclass 627. Apparatus having a moving or movable electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

198, through 226, for electrolytic apparatus with movable electrode means.

623+, for electrophoretic or electro-osmotic coating or forming apparatus with a moving or movable electrode.

649, for an electrophoretic or electro-osmotic bulk separator for solids and liquids with a moving or movable electrode.

650, for electrophoretic or electro-osmotic apparatus with a moving or movable electrode, in general.

668+, for electrical apparatus used to separate or purify liquid with a moving or movable electrode.

630 Ion selective:

This subclass is indented under subclass 627. Apparatus in which the barrier distinguishes between ions of different charges to effect separation.

(1) Note. Barrier separators which distinguish between ions having different levels of positive or negative charge are included here as well as those distinguishing between positive and negative charge.

(2) Note. The ion selective barrier may be a permiselective or ion exchange membrane.

631 With bipolar membrane:

This subclass is indented under subclass 630. Apparatus having a membrane with anionic properties on one side and cationic properties on the other.

632 And ion exchange material (e.g., suspended ion exchange resin particles, etc.):

This subclass is indented under subclass 630. Apparatus in which ion exchange material (e.g., suspended ion exchange resin particles, etc.) is also used.

SEE OR SEARCH THIS CLASS, SUBCLASS:

626, for electrophoretic or electro-osmotic coating or forming apparatus with ion exchange material for regeneration or replenishment of a coating bath or electrolyte.

633 Both anion and cation selective membranes:

This subclass is indented under subclass 630. Apparatus in which at least one membrane selectively passes ions with a positive charge and at least one other membrane selectively passes ions with a negative charge.

634 Alternating anion and cation selective membranes:

This subclass is indented under subclass 633. Apparatus in which at least 3 anion and cation selective membranes are employed in an alternating sequential array (e.g., 2 anion selective membranes separated by a cation selective membrane, etc.).

635 Tortuous path-type frame or membrane spacer:

This subclass is indented under subclass 634. Apparatus having a frame or spacer configured to direct liquid in a tortuous flow path (e.g., zig-zag, twisted, back and forth, etc.).

636 With foraminous or perforated membrane support or spacer (e.g., screen, perforated plate, fabric, etc.):

This subclass is indented under subclass 634. Apparatus having a foraminous or perforated membrane support or spacer (e.g., screen, perforated plate, fabric, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

638, for an ion selective barrier separator with a foraminous or perforated membrane support or spacer but without both anion and cation selective membranes.

639, for a nonion selective barrier separator with a foraminous or perforated membrane support spacer.

637 And nonion selective membrane:

This subclass is indented under subclass 630. Apparatus which also has at least one membrane which does not exhibit ion selectivity.

638 With foraminous or perforated membrane support or spacer (e.g., screen, perforated plate, fabric, etc.):

This subclass is indented under subclass 630. Apparatus having a foraminous or perforated membrane support or spacer (e.g., screen, perforated plate, fabric, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

636, for an ion selective barrier separator with alternating anion and cation selective membranes and a foraminous or perforated membrane support or spacer.

639, for a nonion selective barrier separator with a foraminous or perforated membrane support or spacer.

639 With foraminous or perforated membrane support or spacer (e.g., screen, perforated plate, fabric, etc.):

This subclass is indented under subclass 627. Apparatus having a foraminous or perforated membrane support or spacer (e.g., screen, perforated plate, fabric, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

636, for an ion selective barrier separator with alternating anion and cation selective membranes and a foraminous or perforated membrane support or spacer.

638, for an ion selective barrier separator with a foraminous or perforated membrane support or spacer but without both anion and cation selective membranes.

640 Cylindrical barrier (e.g., filter, membrane, etc.):

This subclass is indented under subclass 627. Apparatus having a separation barrier (e.g., filter, membrane, etc.) in the form of a cylinder or annulus.

641 Absorbent strip (e.g., cellulose acetate, paper strip, etc.) type:

This subclass is indented under subclass 600. Apparatus having a sheet or strip of absorbent material (e.g., cellulose acetate, paper strip, etc.) on which a separation by the differential migration of ions or particles takes place.

(1) Note. Use of the term “paper” broadly in an apparatus of this type is considered proper for this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

546, for corresponding processes.

642 Movable strip:

This subclass is indented under subclass 641. Apparatus in which the absorbent strip is movable.

643 Dielectrophoretic (i.e., using nonuniform electric field):

This subclass is indented under subclass 600. Apparatus in which a nonuniform electric field is used to separate particles or ions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

547, for corresponding processes.

644 Isoelectric focusing (i.e., using pH variation):

This subclass is indented under subclass 600. Apparatus in which a pH gradient is established in the medium to affect the migration of different particles or components based on their isoelectric points (the point having a pH at which the net charge on the particle or component is neutral).

SEE OR SEARCH THIS CLASS, SUBCLASS:

548, for corresponding processes.

610, for gel electrophoresis-type isoelectric focusing apparatus.

645 Isotachophoretic (i.e., displacement electrophoretic) or means to measure ion or particle mobility:

This subclass is indented under subclass 600. Apparatus having means involving different ion or particle mobilities (e.g., ions or particles having the same charge and given the same initial velocity are separated based on their differing net mobilities, etc.) or means to merely measure ion or particle mobility.

SEE OR SEARCH THIS CLASS, SUBCLASS:

549, for corresponding processes.

647 Particle bed separator (e.g., inert particles, ion exchange beads, etc.):

This subclass is indented under subclass 600. Apparatus using a bed of particles (e.g., inert particles, ion exchange beads, etc.) to facilitate separation.

648 Bulk separator for solids and liquids (e.g., to dewater solids, clarify water, etc.):

This subclass is indented under subclass 600. Apparatus having nonanalytical, large scale separation means for solids and liquids (e.g., to dewater solids, clarify water, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

553, for corresponding processes.

649 With moving or movable electrode:

This subclass is indented under subclass 648. Apparatus having a moving or movable electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

198, through 226, for electrolytic apparatus with movable electrode means.

623+, for electrophoretic or electro-osmotic coating or forming apparatus with a moving or movable electrode.

629, for an electrophoretic or electro-osmotic barrier separator with a moving or movable electrode.

650, for electrophoretic or electro-osmotic apparatus with a moving or movable electrode, in general.

668+, for electrical apparatus used to separate or purify liquid with a moving or movable electrode.

650 With moving or movable electrode:

This subclass is indented under subclass 600. Apparatus having a moving or movable electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:

198, through 226, for electrolytic apparatus with movable electrode means.

623+, for electrophoretic or electro-osmotic coating or forming apparatus with a moving or movable electrode.

629, for an electrophoretic or electro-osmotic barrier separator with a moving or movable electrode.

649, for an electrophoretic or electro-osmotic bulk separator for solids and liquids with a moving or movable electrode.

668+, for electrical apparatus used to separate or purify liquid with a moving or movable electrode.

660 Apparatus for electrical (including simultaneous electrical and magnetic) separation or purification of liquid or magnetic treatment of liquid (other than separation):

This subclass is indented under subclass 193. Apparatus specialized for (a) electrical (including simultaneous electrical and magnetic) separation or purification of liquid or (b) magnetic treatment, per se, when some effect other than separation is desired or produced.

(1) Note. This subclass and the subclasses indented hereunder primarily provide for

electrostatic separators designed to treat liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

194+, for electrolytic apparatus.
554+, for corresponding processes.
600+, for electrophoretic or electro-osmotic apparatus.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 15+ for electric field separation apparatus used to separate gaseous mixtures without involving chemical reaction to convert one or more constituents to other compounds (including degasifying means for liquid), but and apparatus for simultaneous or sequential combinations of electrical degasification of a liquid with a Class 204 type electrical separation of a liquid is provided for in Class 204. (This remains true for placement of apparatus used to perform such combined processes regardless of whether a chemical reaction is or is not involved).

196, Mineral Oils: Apparatus, for apparatus to treat or separate mineral oil by more than mere physical separation (provided for in Class 210, subclasses 767+) with or without means to apply electrical or wave energy as long as such means is only used to heat the mineral oil under treatment.

210, Liquid Purification or Separation, appropriate subclasses for apparatus used to perform general purification or separation of a liquid, especially water or waste water, utilizing electrical or wave energy (except the type provided for in Class 204 unless (1) the Class 204 type apparatus is merely used to produce a reagent employed in a process otherwise provided for in Class 210 above subclasses 767+ (e.g., electrolytic production of free chlorine in salt water which is employed to sterilize the salt water under treatment, etc.) or (2) the 204 type apparatus includes means to perform at least one separate step provided for in Class 210 above subclasses 767+ and except for general chemical apparatus (as provided for in Class 422) to treat a medium other than liquid water or waste water). Also, see the line note drawn to Class 196 above for other apparatus used to resolve oil and water emulsions or dispersions.

399, Electrophotography, subclass 250 for liquid carrier condensation of liquid developer material within an electronphotographic device.

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, for general chemical treatment apparatus including that used to sterilize or disinfect without involving electrolysis, electrophoresis, or electro-osmosis; especially subclasses 127+ for apparatus having means to initiate or perfect a process using shock or sound waves and subclasses 186+ for apparatus having means for initiating or perfecting a chemical reaction using electromagnetic wave energy or corpuscular radiation.

435, Chemistry: Molecular Biology and Microbiology, for a process or apparatus involving measuring or testing by electrical or wave energy which is separate and apart, but in combination with a process or apparatus for use with a viable micro-organism or a catalytically active enzyme; and for a process or apparatus involving electrical or wave energy treatment of a micro-organism or an enzyme when the treatment is solely disclosed for use with a viable micro-organism or a catalytically active enzyme.

661 With control means responsive to sensed condition:

This subclass is indented under subclass 660. Apparatus in which means are provided to detect an apparatus or process characteristic or change therein and to control or regulate operation of the apparatus or process based on the detected characteristic or change therein.

(1) Note. A single means may be used both to detect an apparatus or process characteristic or a change in a characteristic and to implement an action in the pro-

cess based upon the detected characteristic or change therein. There must be a positive action made by a control means because of the detected characteristic or change therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

556, for similar corresponding processes with control responsive to a measured parameter.

SEE OR SEARCH CLASS:

73, Measuring and Testing, as the residual class for processes and apparatus for measuring or testing, per se. Also see the (3) Note in the class definition of Class 73 for additional loci of other measuring and testing processes and apparatus of different types.

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous systems for controlling the current and/or voltage in a single circuit.

324, Electricity: Measuring and Testing, for measuring, testing, or sensing, per se, to determine electrical properties by electrical means even though non-electrical values may be derived from the electrical properties determined.

662 Liquid level sensing means:

This subclass is indented under subclass 661. Apparatus in which means are provided to detect the height of a liquid level or a change therein and to control operation of the apparatus based upon the detected level or change therein.

663 With programmed, cyclic, or time responsive control means:

This subclass is indented under subclass 660. Apparatus which is provided with control means for (a) storing coded instructions or other data which are used to regulate operation of the treating apparatus, (b) repetitively regulating a sequence of operational steps performed in or by the treating apparatus, or (c) causing various system operations to occur according to preset timing sequences or to last for predetermined durations of time (e.g., timer switches, etc.).

(1) Note. This subclass includes any control means which maintains an operating condition, predetermines apparatus operation, or regulates repetition.

(2) Note. This subclass is not intended to provide for apparatus merely using alternating current (AC), per se.

664 With magnetic separating means:

This subclass is indented under subclass 660. Apparatus having means to produce magnetic lines of force in order to separate a constituent or to aid the separation of a constituent from a liquid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

557, for corresponding processes.

SEE OR SEARCH CLASS:

96, Gas Separation: Apparatus, subclasses 1+ for magnetic separating means used to separate gaseous mixtures without involving chemical reaction to convert one or more constituents to other compounds.

210, Liquid Purification or Separation, subclasses 222+ for separators which apply a magnetic field for liquid separation without the use of an electric field.

422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 186+ for apparatus having means for initiating or perfecting a chemical reaction using electromagnetic wave energy or corpuscular radiation and subclasses 127+ for apparatus having means to initiate or perfect a process using shock or sound waves.

665 With filter (e.g., electrostatic filter, etc.):

This subclass is indented under subclass 660. Apparatus in which a foraminous or porous mass (e.g., electrostatic filter, etc.) is used to physically trap one or more constituents while allowing the remaining liquid to pass therethrough.

(1) Note. A filter for this subclass may also be electrically charged (i.e., as an elec-

trode) to preferentially attract one or more constituents in the liquid under treatment, provided that physical entrapment also occurs at the filter.

SEE OR SEARCH THIS CLASS, SUBCLASS:
562, and 571, for similar processes.
674, for electrical separation apparatus having a porous, perforated, or grid electrode.

666 Plural separate treatment chambers or zones:
This subclass is indented under subclass 660. Apparatus having two or more physically separate areas to treat a liquid under separation.

(1) Note. The separate areas may be in different chambers or housed in the same chamber, provided that there are at least two clearly different and distinguishable zones for liquid treatment.

667 Probe type:
This subclass is indented under subclass 660. Apparatus in the form of a single electrode, per se, or a modular insert (containing one or more electrodes along with other elements) to be placed into a liquid treatment chamber or vessel.

668 With moving or movable electrode:
This subclass is indented under subclass 660. Apparatus in which an electrode is either moving or movable.

SEE OR SEARCH THIS CLASS, SUBCLASS:
198, through 226, for electrolytic apparatus with movable electrode means.
623, 629, 649, and 650, for electrophoretic or electro-osmotic apparatus with a moving or movable electrode.

669 Rotating or rotatable:
This subclass is indented under subclass 668. Apparatus in which the moving or movable electrode is either rotating or rotatable.

SEE OR SEARCH THIS CLASS, SUBCLASS:
199+, and 212+, for electrolytic apparatus with rotary electrode means.

670 Concentric electrodes:
This subclass is indented under subclass 660. Apparatus in which one or more electrodes are arranged concentrically within another electrode.

(1) Note. This subclass and the subclass indented hereunder is intended to be interpreted broadly, including any such apparatus with an outer electrode at least partially wrapped around an inner electrode having a common axis, provided that at least a portion of the electrodes are overlapped along a radial line.

SEE OR SEARCH THIS CLASS, SUBCLASS:
260, and 272, for electrolytic apparatus with concentrically arranged electrodes.

671 Cylindrical or annular:
This subclass is indented under subclass 670. Apparatus in which at least the overlapping portions of the concentric electrodes are cylindrical or annular in shape.

672 Parallel plate-type electrodes:
This subclass is indented under subclass 660. Apparatus in which at least two plate-type electrodes are arranged in parallel fashion.

(1) Note. This subclass and the subclass indented hereunder are also intended to provide for bent or curved plate electrodes positioned in parallel relationship.

673 Vertical flat plates:
This subclass is indented under subclass 672. Apparatus in which the parallel plate-type electrodes are flat and arranged vertically during operation.

674 Porous, perforated, or grid electrode:
This subclass is indented under subclass 660. Apparatus having at least one porous, perforated, or grid electrode.

SEE OR SEARCH THIS CLASS, SUBCLASS:
665, for an electrical separation apparatus in which a porous electrode also serves as a filter to physically remove

one or more constituents from a liquid.

CROSS-REFERENCE ART COLLECTIONS

The following subclasses (art collection subclasses 900-914) of published disclosures pertain to various aspects of art relating to the use of energy in preparing or treating various chemical compounds.

(1) Note. Disclosure are placed for value as a search aid and in no instance do they represent the entire extent of the prior art.

900 EFFECTING A CHANGE IN ISOMERIZATION BY WAVE ENERGY:
Subject matter involving processes of utilizing wave energy in effecting a process to distinguish two or more compounds having the same percentage composition therein of atoms but which compound differ in the relative positions ot the atoms in the compound therefore giving different chemical and physical properties, i.e., isomers.

901 EFFECTING A COLOR CHANGE BY WAVE ENERGY:
Subject matter involving a process of effecting a color change in a material through the use of wave energy.

902 PRODUCTION OF DESIRED COMPOUND BY WAVE ENERGY IN PRESENCE OF A CHEMICALLY DESIGNATED NONREACTANT CHEMICAL TREATING AGENT (EXCLUDING WATER, CHLOROFORM, CARBON TETRACHLORIDE, METHYLENE CHLORIDE OR BENZENE):
Subject matter involving preparing a desired compound or element by a reaction involving wave energy and wherein said reaction is achieved in the presence of a designated nonreactant material which is other than water, chloroform, carbon tetrachloride, methylene chloride or benzene.

(1) Note. A designated nonreactant chemical material is a material that is present during the wave energy process and is generally inert, although some reaction with the material may occur. The material, however, cannot be one of the principal reactants nor may it add atoms to the principal reactants so as to change the chemical or physical properties thereof to a significant degree. Intended to be included herein are catalysts, diluents, etc.

(2) Note. Designated for purposes of this area is a material from which an atom can be deduced with certainty.

(3) Note. Water in any of its various physical forms or air is excluded herefrom as being designated. Also excluded herefrom is a material stated as organic or inorganic. Other materials excluded herefrom are chloroform, carbon tetrachloride, methylene chloride and benzene.

903 INORGANIC CHEMICAL TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is in elemented form or is in the form of an inorganic compound.

(1) Note. An inorganic compound is one that does not meet the definition of "organic" as elaborated in subclass 157.6

904 METAL TREATING AGENT:
This subclass is indented under subclass 903. Subject matter wherein the designated nonreactant chemical material contains a metal atom in either elemental or compound form.

905 HEAVY METAL AGENT:
This subclass is indented under subclass 904. Subject matter wherein the metal atom present has a specific gravity of more than four.

907 SILICON OR BORON TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one atom of silicon or boron.

908 PHOSPHORUS TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one atom of phosphorus.

909 HEAVY METAL TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one metal atom whose specific gravity is greater than four.

910 SULFUR TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one atom of sulfur.

911 NITROGEN TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one atom of nitrogen.

912 OXYGEN TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one atom of oxygen.

913 PEROXIDE AGENT:
This subclass is indented under subclass 912. Subject matter wherein the designated nonreactant chemical material is organic and contains at least one -0-0- moiety.

914 ONLY CARBON, HYDROGEN OR HALOGEN ATOM IN TREATING AGENT:
This subclass is indented under subclass 902. Subject matter wherein the designated nonreactant chemical material is organic and contains only atoms of carbon, hydrogen or halogen.

(1) Note. Halogen is limited to fluorine, chlorine, iodine, bromine and astatine.

FOREIGN ART COLLECTIONS

The definitions of the Foreign Patent /NPL Art Collections below correspond to the definitions of the abolished subclasses from which these Collections were formed. See the Foreign Patent/NPL Art Collection schedule for specific correspondences.

FOR 920 ELECTROLYTIC OBJECT PROTECTION APPARATUS:
Foreign art collection for electrolytic apparatus under the class definition in which an electrical current or potential is utilized or applied to prevent corrosion, scale formation, or other objectionable action in or on any object in order to neutralize or correct such action when the object is in normal use. The current or potential impressed may be for the purpose of neutralization or it may be employed to give the object to be protected an electrical condition effective for the prevention or modification of objectionable action.

(1) Note. This collection does not include apparatus for the electrolytic treatment of fluids in order to modify their properties so that they do not cause or accelerate electrolytic action. Such electrolytic apparatus is provided for in the appropriate subclass which is dependent upon the structure or character of the apparatus employed.

(2) Note. Combinations of object protection means as herein defined and outside art devices are here included when no more of said art device is specified than is necessary to provide a setting or locus for the protection means.

SEE OR SEARCH CLASS:
136, Batteries: Thermoelectric and Photoelectric, subclasses 200+ for thermoelectric batteries.
307, Electrical Transmission or Interconnection Systems, subclass 95 for anti-electrolysis devices specialized for or appurtenant to electrical systems of distribution.

FOR 921 Internal battery:
Foreign art collection under collection FOR920 in which the anti-electrolysis device includes means for creating an internal battery action within or upon the object being protected.

SEE OR SEARCH THIS CLASS, SUBCLASS:
248+, for other internal battery electrolytic cells which are not used for object protection.

FOR 922 ELECTROLYTIC CELLS WITH CURRENT CONTROL MEANS:
Foreign art collection for electrolytic apparatus under the class definition including an electrolytic cell and means for controlling the supply of current to members of said cell.

SEE OR SEARCH THIS CLASS, SUBCLASS:
204, 205, 211, 218, and 223 for other electrolytic apparatus with current control.

SEE OR SEARCH CLASS:
323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous systems for controlling the current and/or voltage in a single circuit.

FOR 923 With fluid pressure, flow, or level intercontrol:
Foreign art collection under collection FOR922 which includes means to intercontrol the electrical current flow to the cell, in accordance with the fluid pressure, flow, or level to, through, or in the cell, or developed thereby.

FOR 924 Gaseous fluid:
Foreign art collection under collection FOR923 in which the fluid is a gas.

FOR 925 Auxiliary electrode:
Foreign art collection under collection FOR922 in which the current control includes means to control the current to an auxiliary electrode.

FOR 926 ELECTROLYTIC FUSED BATH CELLS:
Foreign art collection for electrolytic cell apparatus under the class definition specialized for fused bath electrolysis.

FOR 927 Bath current distribution, magnetic field control:
Foreign art collection under collection FOR926 with means for distribution of electrolytic current within the bath or means to control the magnetic field created in such a bath.

SEE OR SEARCH CLASS:
205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, subclasses 640+ for electrolytic erosion of a workpiece for shape or surface change (e.g., etching, polishing, etc.).

FOR 930 ELECTROLYTIC CELLS WITH FEEDING AND/OR WITHDRAWAL MEANS:
Foreign patent and non-patent literature collection for electrolytic apparatus including an electrolytic cell provided with means to feed and/or withdraw material from the cell.

FOR 931 ELECTROLYTIC ELECTRODE ELEMENTS WITH ELECTRODE SUPPORTING MEANS:
Foreign patent and non-patent literature collection for electrolytic apparatus having an electrolytic electrode combined with a supporting means therefor.

FOR 932 LAMINATED OR COATED ELECTROLYTIC ELECTRODE ELEMENTS:
Foreign patent and non-patent literature collection for electrolytic apparatus having a laminated or coated electrolytic electrode.

FOR 933 Dielectric film-forming metal base, insoluble conductive coating:
Foreign patent and non-patent literature collection for an electrolytic electrode having an electrically insulating film-forming metal base layer and an insoluble electrically conducting coated layer.

FOR 934 ELECTROLYTIC ELECTRODE SUPPORTS AND WORK HOLDERS:
Foreign patent and non-patent literature collection for an electrolytic apparatus element in which the element is an electrode support or a work holder specialized for use in electrolytic processes of this class.

FOR 935 Workpiece held by magnetism or suction:
Foreign patent and non-patent literature collection having magnetic or suction type means for holding a workpiece.

FOR 936 Workpiece rack:

Foreign patent and non-patent literature collection having a framework, stand, or grating on or in which workpiece articles can be held for treatment (e.g., porous wire basket, overhead bar holding suspended frame and attached workpiece, etc.).

(1) Note. Although a workpiece rack is often equipped to support plural workpieces, this is not a requirement for inclusion in this collection.

FOR 937 Biological, e.g., microbe, enzyme, antigen, etc.:

Apparatus under subclass 400 which includes a biological material, or is adapted to measure electrolytically some property of a biological material.

(1) Note. This subclass is intended to provide for the use in an electrolytic measurement of a micro-organism, enzyme, antigen or antibody when such process is not provided for in another superior class.

END